THE WONDERLAND OF KNOWLEDGE

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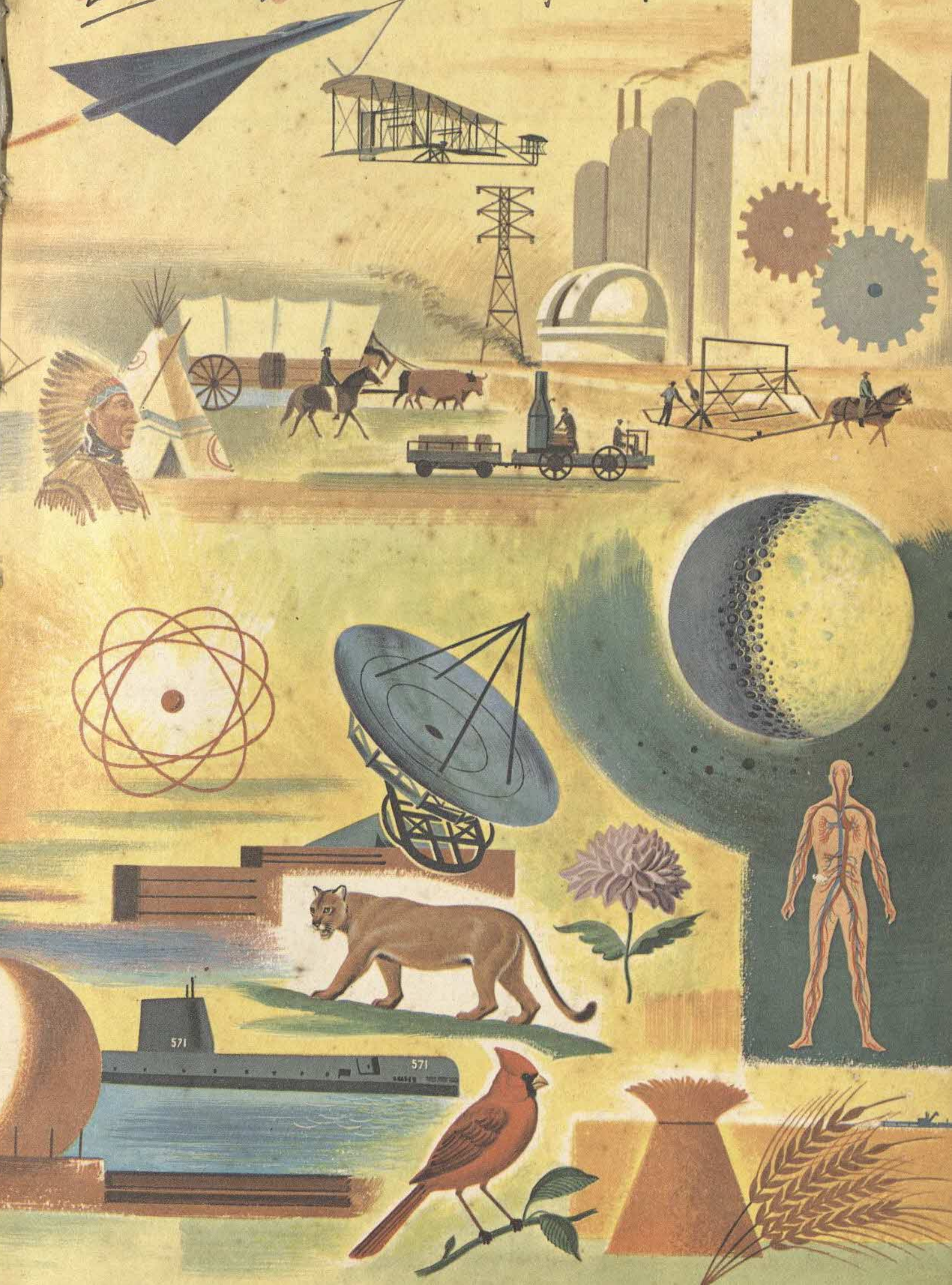

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SENIOR [illegible] TRAINING COLLEGE
BANIPUR.

THE WONDERLAND OF KNOWLEDGE

The Pictorial Encyclopedia

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PRONUNCIATION

The pronunciation of titles is indicated by accenting the word or by respelling it phonetically in italics. In the phonetic spelling, letters are used to indicate the sounds which they most commonly represent.

A vowel is *short* when followed by a consonant in the same syllable, unless the syllable ends in silent *e*.

A vowel is *long* when the letter occurs in a syllable which ends in silent *e* or when ending an accented syllable.

The hard sound of *c* is represented by *k*.

The hard sound of *s* is represented by *z*.

The foreign sounds which have no equivalent in the English language are represented as follows:

N for the French *n*, as in Breton: (**Breton,** *bre toN'*).

ö for the German *ö*, as in Göttingen: (**Göttingen,** *gö' ting en*).

ü for the German *ü*, as in Blücher: (**Blücher,** *blük'ur*).

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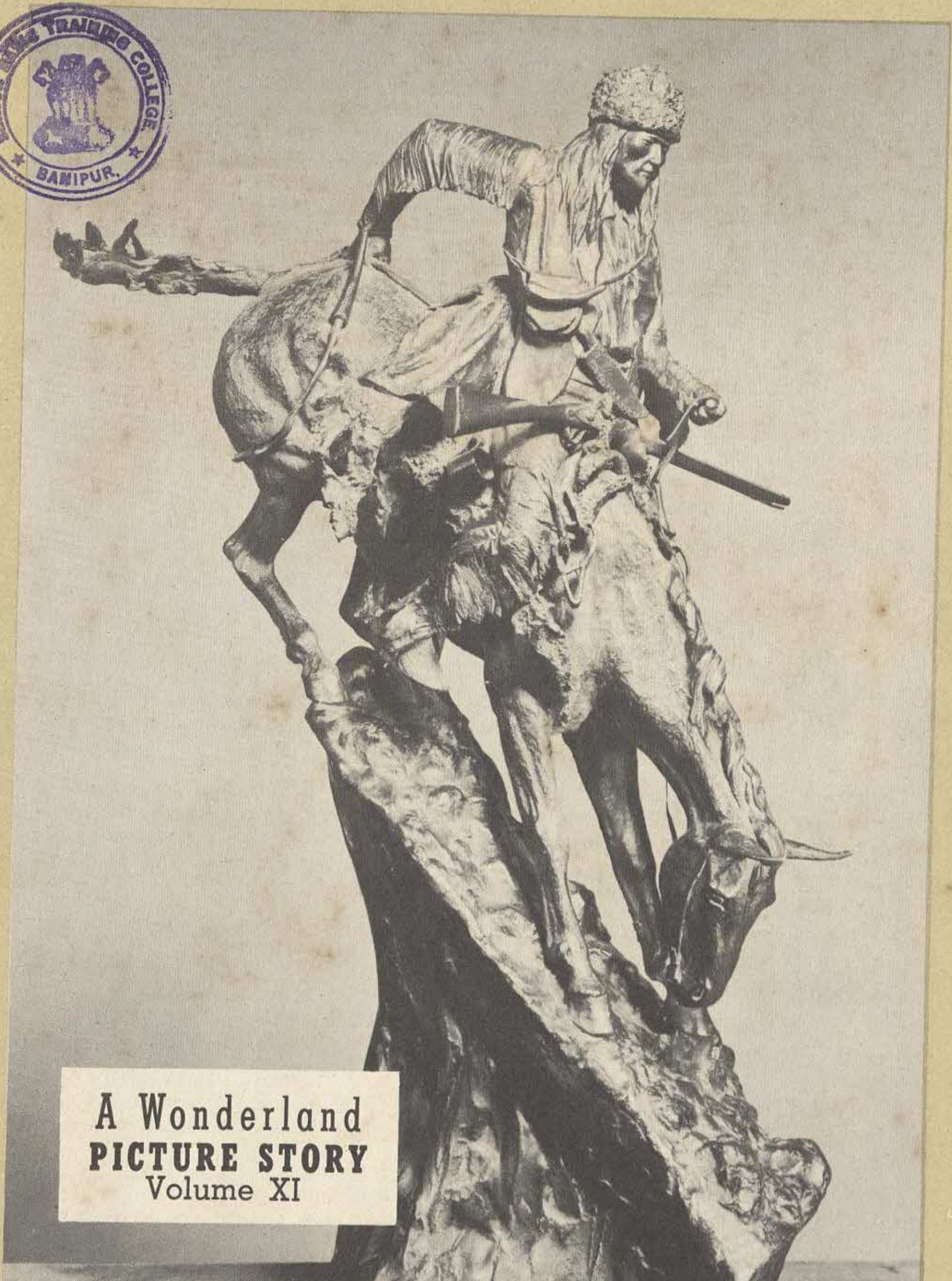
SENIOR BASIC TRAINING COLLEGE, BANIPUR.

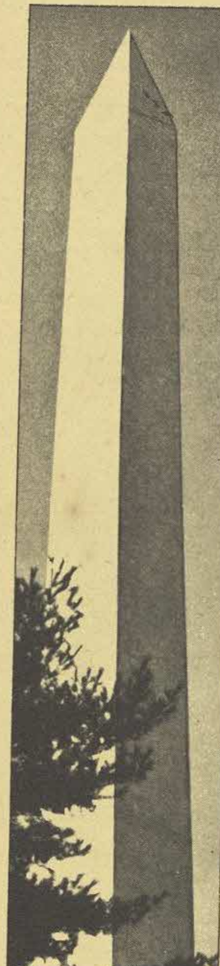


A Wonderland
PICTURE STORY
Volume XI

The Metropolitan Museum of Art

SCULPTURE. "Mountain Man" shows the spirited action typical of the works of its sculptor, Frederic Remington, an American. See page 3044.

Fact-Finding in Volume XI



WASHINGTON MONUMENT

This white marble memorial to the first President was dedicated in 1885.

Why is the Battle of Saratoga in the Revolutionary War considered one of the decisive battles of world history?

The battle was the turning point of the war, for, besides greatly weakening the British campaign in America, the victory of the colonial forces encouraged the French to hope that their rival, England, might be defeated, and it thus prompted them to aid the colonists, insuring the independence of the new nation. See SARATOGA, BATTLES OF.

What and where is the Sargasso Sea?

In the North Atlantic Ocean, south of the Azores, floats a vast stretch of seaweed and other marine debris, collected and deposited in this spot by the great oceanic currents. This is the Sargasso Sea, first viewed by Columbus. It is about 2,000 miles by 400 miles in its dimensions. See SARGASSO SEA.

Why is Saturn a thrilling sight?

Encircled by its broad, seemingly flat, band of rings, Saturn is truly an object of wonder in the sky. The rings, first sight of which has thrilled every stargazer since their discovery, are composed of millions upon millions of minute particles, each acting as if it were a special satellite, or moon, of the planet. See SATURN.

Why is the fur of the young male seals the most valuable obtained from the animals?

Each spring when the seals return to the Pribilof Islands from their winter sojourn in the waters of the Pacific, the older and larger males fight one another fiercely for the possession of mates. The younger males keep out of the fights; thus their pelts have a finer quality. See SEAL.

Is Daniel Defoe's famous story of Robinson Crusoe founded on fiction or fact?

Early in the eighteenth century, one Alexander Selkirk, a pirate in the South Pacific, was put ashore, at his own request, on one of the uninhabited Juan Fernandez Islands. He was picked up about four and a half years later and returned to Scotland. When his adventures became known, Defoe wove them into his story, considered the first modern English novel. See SELKIRK, ALEXANDER.

Where did sheep come from and how did they get to America?

It is believed that sheep were first used as domestic animals around the shores of the Mediterranean Sea, Spain in particular containing large, fine flocks. They were brought to America, principally to Mexico and Florida, by the Spanish; probably many of our present flocks are descended from those imported over five centuries ago. See SHEEP.

Why is Singapore called "the crossroads of the British Empire"?

This great port is situated at the very tip of the Malay Peninsula, opposite the long islands of Sumatra and Java and others of the East Indies to the southwest and south. As a result, ships traveling between the Indian Ocean and the North Pacific must either come to Singapore's front door or travel thousands of miles farther around the East Indian Islands. See SINGAPORE.

What makes floating soaps float?

They are mixed in a machine called a *crutcher*, which fills them with air yet gives them a smooth texture. The air makes them less dense, allows them to float. Other soaps are *milled*, or pressed in rollers. They are given the fineness desired for toilet soaps, but have the air squeezed out. See SOAP.

How does the tailor bird get its name?

The bird makes its nest of cotton and other soft materials, and then encloses it in a large leaf, sewing the ends together with bits of thread. For a bird, it is really not a bad "tailor." See TAILOR BIRD.

Where is the oldest known city in the world?

Along the Tigris River in modern Iraq is the *Great Mound*, the world's oldest settlement. See TEPE GAWRA.

TRAINING COLLEGE
RAIPUR

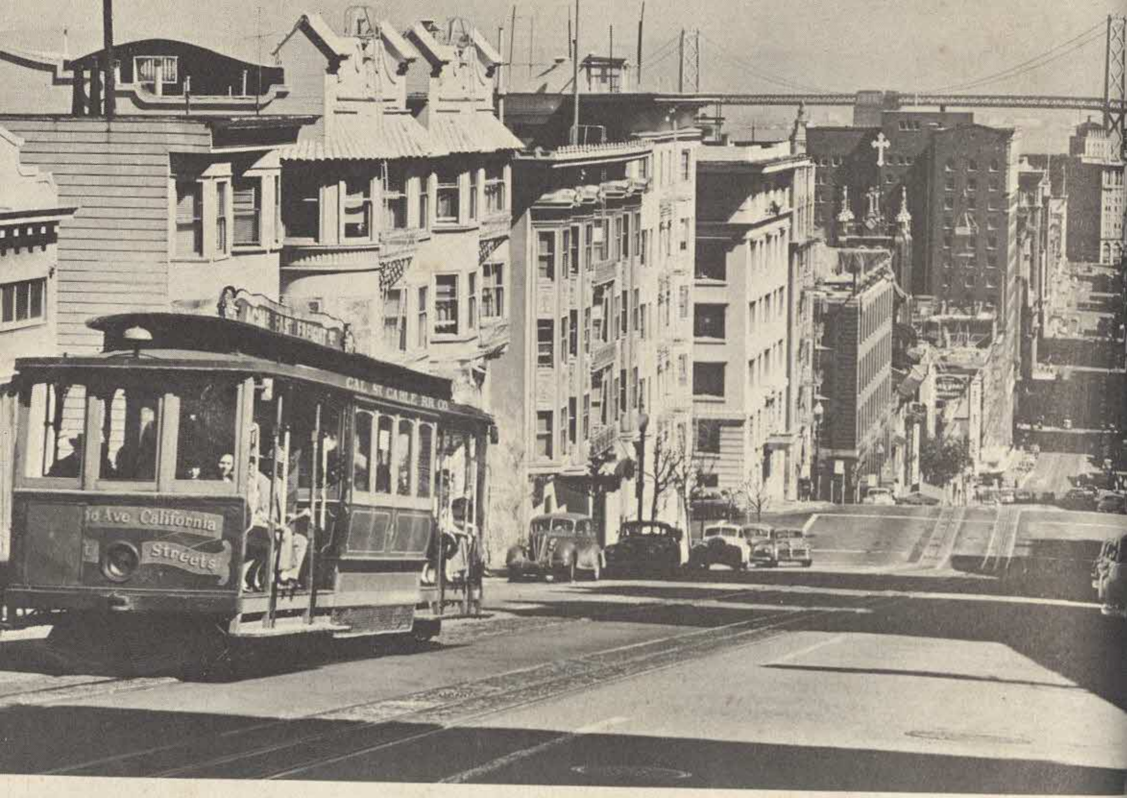
Gateway to the Pacific

Colorful San Francisco (background, above) is linked with Oakland and the East Bay cities by the Transbay Bridge. The bridge has two decks and carries both rail and motor traffic. The structure includes 4½ miles over water and, with its approaches, totals 8¼ miles.

Burlington Route Photo

SAN FRANCISCO, *san fran sis′ko,* CALIF. On a narrow, hilly peninsula, which lies south of California's Golden Gate, is the fascinating city of San Francisco, facing the Pacific Ocean on the west and San Francisco Bay on the east. Because of its location on one of the world's finest natural harbors, the city is a busy seaport, visited by ships laden with fruits, tea, coffee, spices, and silks of the Orient. In exchange the ships receive the products of American mines and factories, forests and fields, brought to the port by transcontinental railways from all parts of the United States. Oakland and San Francisco are connected by the world's longest suspension bridge, the San Francisco-Oakland Bay Bridge, while the entrance to the harbor is spanned by the beautiful single-span Golden Gate Bridge.

A Picture of San Francisco. Along the water front are blocks of wharves and warehouses. Back of them are the manufacturing and business centers of the city, flanking either side of Market Street for several blocks above the Embarcadero. Broad Market Street, with its four streetcar tracks to accommodate the city-owned and privately owned streetcar systems, divides the city into the old section on the south, known as the Mission, and the modern section on the north. The car lines



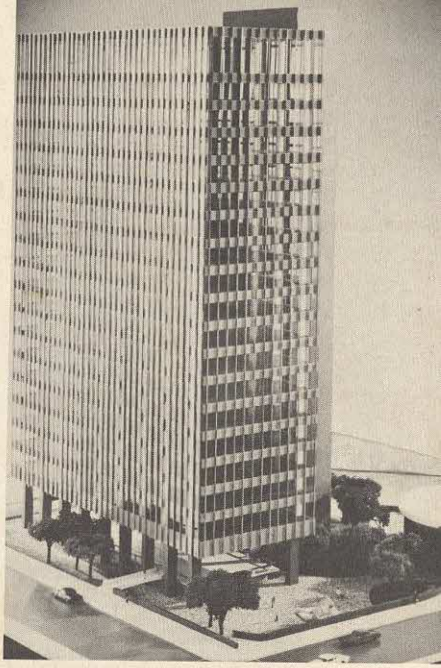
TOURIST ATTRACTION IN THE GOLDEN GATE METROPOLIS
Colorful cable car crawls slowly up Nob Hill in San Francisco. Tourists often disembark at top of hill and help turn car around for return trip. Transbay Bridge is in background.
San Francisco Chamber of Commerce

from various parts of the city converge at the Ferry Building at the foot of Market Street. This building is the San Francisco terminal of railroad lines which convey passengers across the bay by ferry. Local traffic uses the San Francisco-Oakland and Golden Gate bridges.

Following the earthquake and resulting fire of 1906, which wiped out the heart of the city, San Francisco was rebuilt with modern office buildings and beautiful public edifices. Noteworthy is the Civic Center, about which are grouped the public library, the Auditorium, the city hall, the State Building, and the War Memorial Building, which is used by the civic opera and symphony orchestra.

The fact that San Francisco is built on several hills has led to the settlement of small areas by various nationality groups. Of particular interest are the Latin Quarter, Chinatown, and the Japanese, Mexican, Spanish, and Greek sections. The mingling of races and nationalities from all over the world gives the city a cosmopolitan and even Bohemian atmosphere that is stimulating.

The city is well provided with parks and playgrounds. The most important park is Golden Gate Park, of more than a thousand acres, containing the Museum of the Academy of Sciences, the Steinhart Aquarium, and the delightful Oriental Japanese Tea Garden. Other points of interest are the Presidio, a government reservation; Lincoln Park, at the end of the transcontinental Lincoln Highway; and the Cliff House and Seal Rocks. Educational institutions within the city include San Francisco University, Teachers' College, and professional schools of the University of California (at Berkeley) and Stanford University (in Palo Alto). Mills College, for



CITY OF UNUSUAL MIXTURES
San Francisco's Chinatown, top left, is the largest Oriental community in the Western Hemisphere. Note narrow, hilly street. "Floating" skyscraper, above, completed in 1958, rests on a concrete mat eight feet thick, rather than on a pile-driven foundation. Building has no interior pillars. Fisherman's Wharf, left, on the Bay, is famous for its colorful Italian and seafood restaurants.

women, is located in Oakland.

History. Sir Francis Drake, during his voyage around the world, anchored in a bay north of the Golden Gate in 1579. In 1769 Portola, governor of Lower California, entered San Francisco Bay, and about seven years later a group of Franciscan monks established a mission, which was followed by a Spanish fort. In 1821, with Mexican independence, San Francisco came under the Mexican flag, and following the Mexican War it became United States territory. The growth of the settlement really began with the discovery of gold in California in 1848. San Francisco was incorporated in 1850. With a population of about 723,000, it ranks twelfth in size among cities of the United States. See CALIFORNIA.

SANHE'DRIN. The chief council of the Jews at the time of Christ was the Sanhedrin. Before it He was tried and found guilty of blasphemy. Composed of seventy-one members, it was presided over by the high priest. Daily sessions were held in the temple, to hear the various complaints. The Sanhedrin is thought at one time to have had authority over civil, criminal, and religious matters, but its power was restricted to matters of religion after the Romans took control of Palestine, and it disappeared altogether in A. D. 70, with the fall of Jerusalem.

SANITARY SCIENCE. The maintenance of healthful conditions in a community is carried on by means of the engineering and medical professions. The work of engineers and physicians is combined in what is known as sanitary science. Boards of health and health officers supervise this work, and are responsible for providing pure drinking water and maintaining proper sewage disposal, and for any other measures necessary to control disease. Local ordinances make regulations as to sanitary conditions in restaurants, slaughterhouses, milk plants, barber shops, theaters, and other public places.

Consult the following titles for additional information:

Health, Boards of	Water Purification
Hygiene	Water Supplies

SAN MARINO, *sahn mah re′ no.* The oldest republic in Europe, and the smallest, is San Marino, founded, according to tradition, by Saint Marinus, a Christian who escaped from persecution in Dalmatia in the fourth century. It is situated in the mountains near the Adriatic Sea, not far from the Italian town of Rimini. San Marino has its own government and its own postage stamps and coins. The people of San Marino elect a Grand Council composed of sixty members, one third of whom are elected every three years. Two executives, called Regents, are appointed every six months from the Council. They are aided by committees, or congresses.

The leading occupations of the people are cattle raising, wine making, and stonecutting. The republic has an area of only thirty-eight square miles, and a population of about 12,000. Perched on the craggy top of Mount Titano is the capital, San Marino, a town of about 2,000 inhabitants. The country was overrun by German and Allied armies in World War II.

SAN′SKRIT LANGUAGE AND LITERATURE. The tongue of the inhabitants of ancient India was Sanskrit, a language believed to be at least 4,000 years old. About 200 B. C. its grammatical structure was fixed by scholars, and the more modern language is known as "classical Sanskrit." It was used for most of the secular literature up to about A. D. 1500, but has not been used as a living spoken language for several hundred years. The earliest works in Sanskrit were the Vedas, the sacred books of the Hindus, some of which were written about 1500 B. C. In the literature of the classical Sanskrit are found the originals of many of the fairy tales now common to all languages. See VEDAS.

SANTA ANNA, or SANTA ANA, *sahn′tah ah′nah,* ANTONIO LOPEZ DE (1795-1876). The leader of the Mexican forces in the war with the United States was General Antonio de Santa Anna, fiery-hearted revolutionary and several times ruler of the Republic of Mexico.

Santa Anna was active in the revolution that won Mexico her independence, and in the final defeat of Spanish attempts to recover Mexico for Spain. After a series of revolutions and counter-revolutions, he became President in 1833. In a few years he had become practically dictator of the entire country.

In 1836, when Texas seceded from Mexico, Santa Anna led his army against the Texan forces, winning a notable victory at the Alamo; but he was defeated at San Jacinto shortly afterward, and taken prisoner by Sam Houston. He guaranteed the independence of Texas, however, and was released. Once more, in 1841, he became President of Mexico, only to be banished to Havana when his opponents came into power in 1844.

Two years later he was recalled to command the Mexican army against the United States in the disastrous Mexican War. The defeats sustained by Santa Anna proved so humiliating that he resigned and left the country; but in 1853 his followers had again secured control and Santa Anna returned as dictator. Two years later, however, he was overthrown and took refuge in Cuba. It was not until 1874, after the death of his enemy, Benito Juarez, that he was able to return to Mexico. His twenty years of exile had carried him into oblivion. In spite of his stormy and spectacular career, his passing in 1876 was almost without notice. See MEXICAN WAR.

SANTA CLAUS. See NICHOLAS, SAINT.

Courtesy Santa Fe R.R.

THE OLD AND NEW IN SANTA FE
Above, the old Palace of the Governors, occupied by Spanish, Indian, Mexican, and American authorities for 300 years. Right, patio of the State Art Museum.

SANTA FE, *san'ta fa',* N. M. On a high plain almost 7,000 feet above sea level, and in sight of lofty mountain peaks, is the old city of Santa Fe, the capital of New Mexico, county seat of Santa Fe County, and one of the largest cities in the state. A feature of the city is the contrast presented by the modern section, with wide streets, large public buildings, and fine homes, and the old Spanish quarter with winding streets and low adobe houses.

The city is built around a public square called the Plaza, which is faced by several interesting structures. Here is the picturesque executive mansion, built of adobe in 1609 and used for 300 years as the residence of the Spanish governors. Since 1909 it has been occupied by the Historical Society. Also of historic interest in the city are the Church of San Miguel, Rosario Chapel, and Fort Marcy. Other important buildings and institutions are the Scottish Rite Cathedral, Cathedral of Saint Francis, Allison Mission, the Mary E. James Mission School, Saint Michael's College, the School of American Archaeology, and several Indian schools.

The city lies in the center of a large stock-raising region, for which it serves as the leading market and distributing point. There are also several coal and kaolin mines nearby, and Santa Fe is a center for the distribution of Indian handcraft. The population is about 45,000.

When the Spaniards visited the site of Santa Fe in 1542, they found there a large Indian village. However, by 1605 the Indian village had gone and the Spaniards founded a settlement on the site. They opened up large gold and silver mines near by and forced the neighboring Indians to work in the mines as slaves. The Indians captured the settlement in 1680, but twelve years later the Spaniards again took control. An army of the United States captured the city in 1846 in the Mexican War.

Five years later, Santa Fe became the capital of the new territory, and in 1890 it was chartered as a city. The city was at one time a great commercial center, extensive trade being carried on over the Santa Fe Trail, which led to Kansas City. The city is the second oldest white settlement in the United States.

IN THE CAPITAL OF CHILE

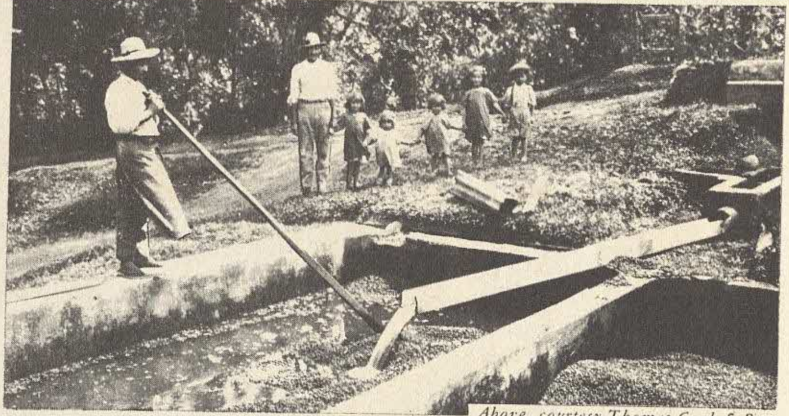
Left, an iron gate leading to the main patio of La Moneda, the executive palace of Chile; above the gate is the national coat of arms. Above, the business section of Santiago de Chile, with well-paved and well-lighted streets.

SANTIAGO, *sahn te ah'go,* CHILE. In a beautiful fertile valley that lies between the Andes and the coastal range of mountains is the large and modern city of Santiago, the capital of Chile. It is situated on the Mapocho River, a branch of the Maipo River, about 115 miles southeast of Valparaiso. Despite its age, having been established by Pedro de Valdivia in 1541, Santiago is a well-planned city with wide boulevards and large buildings.

The outstanding public buildings are the Hall of Congress, the National Library, the Academy of Sciences, the National Museum, the Exposition Palace, and the mint. The city has a beautiful system of parks, a botanical garden, and an observatory. Transportation facilities within the city are excellent, particularly the electric street-railway system. There are railroad lines running from Santiago to Buenos Aires, Concepción, and Valparaiso. The city has a population of about 1,628,000.

SANTIAGO, BATTLE OF. On July 3, 1898, a United States squadron under command of Sampson and Schley completely annihilated Admiral Cervera's Spanish fleet in the harbor of Santiago de Cuba. Having bottled up the Spanish fleet for several weeks at Santiago while the Americans completed the blockade of the city, Sampson and Schley were alert at the moment Cervera, under orders from Spain, attempted a dash from the harbor. A running battle ensued in which every Spanish ship was sunk or beached and Cervera and his 1,700 men captured. Not a single American ship was lost. This victory was soon followed by the surrender of Santiago. See SPANISH-AMERICAN WAR.

SAN'TO DOMIN'GO. See DOMINICAN REPUBLIC.



CITY ON A PLATEAU

São Paulo's location on a tableland 2,500 feet above sea level gives the city a temperate climate, though it is in the tropics. The prosperity of the city's tributary land is reflected in fine government buildings like the Ypiranga Museum above. Right, washing coffee before shipment to Santos, the port.

Above, courtesy Thomas Cook & Son

SÃO PAULO, *souNm pou'loo,* BRAZIL is the largest city and leading manufacturing city of that nation. It is one of the most important exporting centers in South America and capital of the Brazilian state of São Paulo. The city is built on a high plateau, and has a pleasant and healthful climate. It is modern, with long, wide streets and large public buildings. The outstanding buildings are the city hospital, the government buildings, the cathedral, a fine municipal theater, and the Ypiranga Museum. The city is noted for its cleanliness and its well-lighted streets.

São Paulo's growth and prosperity are due to the productiveness of the state of which it is the capital. The surrounding area has stores of mineral wealth and extensive areas of fertile soil, devoted chiefly to the raising of coffee. More than half the supply of Brazilian coffee comes from the state of São Paulo. The city is a center of both heavy and light industries, and its products are shipped from its ocean port, Santos, twenty-five miles away. São Paulo is connected by railway with Buenos Aires, Rio de Janeiro, Santos, and other important cities. The city was founded in the middle of the sixteenth century, but it did not become important until 1890. The population is about 3,417,000.

SAP. The life fluid of plants, sap is water containing in solution the various plant foods and giving life to the protoplasm of the cells. If deprived of sap in winter, a tree would probably perish. The change that actually does take place in spring is merely an increase in sap pressure, due to the renewal of the water supply in the soil. For, as explained in the articles DIFFUSION and OSMOSIS, the "flow" of sap is not really a flow at all, but a mingling of fluids of different consistencies.

When maples and birches and other plants "bleed" in the spring, it is because

UNWELCOME ORCHARD VISITOR
Because of its habit of boring holes in trees, the yellow-bellied sapsucker is a nuisance.

of sap pressure, which is due to osmosis in the roots. That is why maple sugaring is most successful when the sugar grove is thickly carpeted with leaves, which prevent the rapid drying of the soil. Maple sugar and maple syrup are the chief commercial products of sap (see MAPLE). The fluid from which rubber is made is not sap, but latex, a secretion.

SAPPHIRE, *saf'ire*. Brilliantly blue in color, the sapphire is a corundum (aluminum oxide) gem. Its value depends on its color. Pale stones are of little value, while those having a strong blue color may be worth nearly as much as the diamond.

The term is also used commercially to cover any corundum gem used in the arts, such as a watch jewel or a phonograph needle. The finer-colored stones are not used for such articles, as the less valuable, poorly colored, or clear stones are equally hard and serve as well.

The chief production in the United States is from Montana. There is no regular production in Canada, though, occasionally, sapphires are found in Quebec. The major sources are Kashmir, Indochina, Thailand, Ceylon, and Burma.

SAP'SUCKER. With a tiny brush at the tip of his tongue, this bird of the woodpecker family wipes the sweet sap out of holes which he bores with his bill in the juicy new wood of trees. Nearly 300 kinds of trees, shrubs, and vines are known to be attacked by sapsuckers, and some of them are so seriously injured as to die; but by far the worst damage is to the wood, unfitting it for many uses because of the so-called "bird pecks" and often consequent decay.

The common *yellow-bellied* sapsucker, which is about eight and a half inches long, is generally black and white in color, but the male has a red crown, a red throat, and a black crescent on the breast, with yellow below. The female has a white throat, and until a year old is black on the crown instead of red. Sapsuckers nest in trees, laying three to seven white eggs. Except for the hole boring, their habits are like those of woodpeckers. See WOODPECKER.

SARACENS, *sar'a senz*. During the Middle Ages, there was a great empire which extended from the Indus River in Asia to the Atlantic Ocean, and from the Pyrenees in Europe to the Sahara Desert in Africa. This was not an empire like that of the Romans, but rather a group of kingdoms held by the Mohammedan Arabs, also known as Saracens.

They were at the height of their power in Spain, where they were known as Moors. The Moors almost succeeded in sweeping over Europe, but they were turned back at the Battle of Tours, in 732, by Charles Martel, who thus saved Christian civilization on the continent. The Saracens of Palestine were the foes of the Crusaders.

SARATO'GA, BATTLES OF. The surrender of the British army under General Burgoyne, October 17, 1777, was the climax of

THE CHRISTIAN "HAMMER" TRIUMPHS AT TOURS
Saracen invasion of Europe was halted when Charles Martel defeated the Moors in 732.

two battles of the Revolutionary War, fought near Saratoga Springs, N. Y. The British had planned to attack the Americans with a combined army of three divisions, under Burgoyne, Howe, and Saint Leger. The three generals were to meet at Albany. Burgoyne, who left Canada in May, reached the vicinity first, and on September 19 engaged the Americans under Benedict Arnold, at Freeman's Farm. The battle, which was indecisive, has been called, variously, the Battle of Freeman's Farm and the First Battle of Bemis Heights, Stillwater, or Saratoga.

Both Saint Leger and Howe were unable to make connections with Burgoyne, and a second battle was fought between his army and the Americans under Arnold on October 7. In this engagement the British were defeated in an attack on the American position on Bemis Heights. With supplies cut off and with no reinforcements, Burgoyne surrendered to General Gates on October 17.

The Battles of Saratoga turned the tide of the Revolution, gave the colonies renewed hope, and so impressed the French that France sent a fleet and an army to help the American cause. See FIFTEEN DECISIVE BATTLES; REVOLUTIONARY WAR IN AMERICA.

SARDINE, *sahr deen′*. From the Mediterranean, the Baltic, and the North Atlantic come sardines, small edible fish of the herring family. The fish are usually only about four inches long. Along the Atlantic coast of North America other small fish, chiefly menhaden and young herring, are caught and canned as "sardines." They are somewhat larger, and while good, are not of such good quality as the true sardine. On the Pacific coast are found California sardines, or "pilchards," which reach a length of a foot.

The sardines so commonly canned swim about in great schools like herring, menhaden, and mackerel. They come to the shores to lay their eggs at breeding time, and are often captured near shore by nets. The fish are preserved in salt in cases or barrels, or are kept in oil in tin cans. Before they are canned, the fish are cleaned, pickled in brine, dried on screens, and boiled in oil.

SARDIN'IA. About 150 miles west of Naples lies the Italian island of Sardinia. Of the Mediterranean islands, Sicily alone outranks Sardinia in size. To the north of Sardinia, across a narrow strait, is the historic island of Corsica, birthplace of Napoleon. Sardinia consists of three provinces: Cagliari, Nuoro, and Sassari. A land of low mountains, rich, fertile valleys, and semi-tropical climate, Sardinia produces wheat, grapes, oranges, lemons, and olives. Wine and olive oil are exported. About a fifth of the area of 9,300 square miles is forested. Other important resources are the lead and zinc mines and sardine and coral fisheries.

Sardinia was once an independent kingdom. Later the Kingdom of Sardinia included Genoa, Piedmont, and Savoy. It led in the movement to unite all of Italy, and in 1861 Victor Emmanuel II, its ruler, became the head of the Kingdom of Italy. See ITALY.

PORTRAIT FROM A FAMOUS HAND
John Singer Sargent's painting of Dame Ellen Terry in her great rôle of Lady Macbeth.

SARGASSO, *sahr gas'o,* **SEA.** In the northern half of the Atlantic Ocean, between 40° and 70° W. and 25° and 31° N., there is a vast stretch of drifting brown seaweed known as the Sargasso Sea. It is about 2,000 miles from east to west and 400 miles wide, and its position is constantly changing, owing to the influence of winds and currents. It is formed by a slow-moving eddy between the great ocean currents. Columbus discovered it on his first voyage. Modern ships avoid the Sargasso Sea because it is a hindrance to navigation. However, there is no basis of fact in the early belief that ships once in the sea were unable to make their way out. Three comparatively recent scientific expeditions to this area, the last in 1925 under William Beebe, have proved the falsity of the old tales about rotting hulks buried in the sea.

SAR'GENT, JOHN SINGER (1856-1925). As a portrait painter, John Singer Sargent was one of the masters of his day. His parents were Americans, but he was born in Florence, Italy, and educated in Europe. He did not visit the United States until he was twenty.

Among his portraits are those of Presi-

PROVINCE OF WHEAT

Saskatchewan leads all the provinces of Canada in growing wheat, produces more than any state of the Union. Above, a typical section of the Prairie Belt. Right, Parliament House, at Regina.

Courtesy Canadian Pacific Railway

dent Theodore Roosevelt, John Hay, Edwin Booth, Ellen Terry, Joseph Jefferson, Madame Gantreau (as Madame X), and the Duke and Duchess of Connaught. But Sargent was also a great painter of other subjects. *Carmencita* (a dancer), *Carnation Lily, Lily Rose,* and *Egyptian Girl* are among his most popular works. His most famous murals were those done for the Boston Public Library. He also left a large number of beautiful water colors.

SASKATCHEWAN, *sas kach'e wahn.* One of the great wheat-growing regions of the world is the province of Saskatchewan in Western Canada. It is bounded by Alberta on the west, the unorganized Northwest Territories on the north, Manitoba on the east, and the American states of North Dakota and Montana on the south. It has an area of 251,700 square miles.

Surface and Climate. Saskatchewan has several distinct geographic zones. The southern part of the province is a flat or rolling prairie, broken in places by hills, lakes, and forested regions. North of the Qu'Appelle River are the Beaver and the Touchwood hills. To the north and east is a section of prairies and woodlands, known as the park belt. It extends to the southern limits of the great northern forests of pine, fir, and spruce. The chief rivers of the province are the Assiniboine, the Souris, and the Churchill. The important lakes are Athabaska, Wollaston, Big Quill, Reindeer, and La Rouge.

Saskatchewan summers are warm. The long, cold winters are moderated to some extent by warm winds from the west.

Agriculture. Saskatchewan is now the leading producer of wheat among the Canadian provinces. Other important agricultural products are oats, barley, flax, rye, potatoes, and hay. There is also a well-developed dairy industry. Dairy products are among the leading export items of the province. Stock raising is also important.

Industry and Transportation. The manufacturing industries are based, for the most part, on the agricultural development. Brick, tile, and other clay products are manufactured to a large extent, as are lumber, flour, and meat products. Mineral deposits include coal, petroleum, gold, and silver.

Transportation is confined chiefly to the highways and railroads. The Canadian Pacific and the Canadian National railways extend east and west through the province and, with their numerous branches, have a combined mileage of about 8,800 miles. There are a number of good highways, located chiefly in the south.

The People and Their Institutions. More than fifty per cent of the people are of British descent; the remainder are largely from Northern Europe and the United States. The majority of the people live in the southern part of the province.

The population is about 902,000. Regina, the capital, has a population of about 89,000; Saskatoon and Moose Jaw are next in population.

The head of the provincial government is the lieutenant-governor, appointed by the Governor-General of Canada. He is assisted by a council of ministers. The legislative assembly is made up of fifty-five members elected for five-year terms. The judiciary is composed of a supreme court and several district courts. Twenty-one members represent the province in the Dominion Parliament at Ottawa.

At the head of the school system, which includes the regular primary and secondary schools and several normal schools, is the University of Saskatchewan at Saskatoon. A minister of education supervises the system. School attendance is both free and compulsory.

History. Saskatchewan has been a province only since 1905. The territory within its boundaries was originally controlled by the Hudson's Bay Company. However, the country was not settled until about 1870.

SASKATCHEWAN REBELLION. In 1885 the half-breed population of Saskatchewan arose against the Canadian government in what is called the Saskatchewan Rebellion. The revolt was an outgrowth of a previous uprising, the Red River Rebellion, and was carried out under the leadership of the same agitator, Louis Riel (see RED RIVER REBELLION; RIEL, LOUIS).

After the Red River Rebellion the half-breeds, or metis, were quieted by grants of land. But the building of the Canadian Pacific Railway and the influx of settlers caused them to fear the loss of their property. So they sent for Riel, who had been in the United States since the earlier rebellion.

Riel was chosen president of a provisional government. Hostilities broke out when a band of sympathetic Cree Indians massacred some settlers. The government sent armed forces to the scene of the trouble, and, after considerable fighting, the rebels were suppressed. Riel was captured and hanged.

SASKATCHEWAN RIVER. Rising in the Rocky Mountains in the western part of the province of Alberta, Canada, two mountain streams flow eastward into the province of Saskatchewan. There they join to form the Saskatchewan River, which continues east for about 300 miles, finally emptying into Lake Winnipeg. This river and the Nelson (which flows from Lake Winnipeg) form one of the great river systems of Canada and the greatest flowing into Hudson Bay.

The two branches which form the main stream are known as the North and the South Saskatchewan. They flow zigzag courses for nearly 900 miles before they come together, thus giving the river a total length of about 1,200 miles. The Saskatchewan is navigable for more than half its course, although in places for only very small boats.

SASKATOON′, SASK. Situated on the Saskatchewan River, in the province of Saskatchewan, is the important industrial and trading city of Saskatoon. With a population of about 72,000, it is the eighteenth largest city in Canada. It is also one of the most important railroad centers in the western part of the Dominion.

Saskatoon's prosperity is due to the fact that it has a trading area of almost 50,000 square miles. The leading manufactured products are clothing, breakfast foods, flour, stoves, and tractors and other machinery. The principal items of wholesale trade in the city are agricultural implements, lumber, groceries, provisions, and hardware. The commerce of Saskatoon is carried by the Canadian National and

Canadian Pacific railways, which lead to Winnipeg, Edmonton, Regina, and other cities. The city is also a financial center.

Among the institutions in the city are the University of Saskatchewan, a technical school, a normal school, three collegiate institutes and an agricultural college.

SAS′SAFRAS. A member of the laurel family, the sassafras tree ranges in size from a large shrub in the northern part of the United States to tall trees exceeding eighty feet in the South. The leaves are oval, two-lobed, and three-lobed, all three kinds sometimes growing on one twig. The flowers are yellowish in color. The oil from the bark is used in medicines and perfumes; the wood, though weak, is durable and makes fine post timber. The roots and bark are often used in making an aromatic tea.

SAT′ELLITE, a secondary planet, or moon, revolving around a larger planet. Only Mercury and Venus do not have satellites. Earth has one, Mars two, Neptune two, Uranus five, Saturn nine, Jupiter eleven. It is not known if Pluto has any satellites because it is so far away. Like the planets, the satellites shine by reflecting the light of the sun.

The first man-made satellite, Sputnik I, was launched by the Russians on Oct. 4, 1957. Explorer I, the first United States satellite, was fired on January 31, 1958. Since then several satellites have gone into orbit around the earth. Lunik I, launched by the Russians on January 2, 1959, went into orbit around the sun. Lunik II struck the moon, and Lunik III photographed the other side of the moon, and then went into an earth-moon orbit. In August, 1960, the United States orbited Echo I, first of a network of balloon satellites used to bounce communications signals from one continent to another. Also in August, 1960, the United States became the first to recover a capsule ejected by an orbiting (Discoverer) satellite. See PLANET.

SAT′IN. The word *satin* is both the name of one of the fundamental weaves or systems of interlacing threads to form cloth, and the name of a large class of silk and synthetic fabrics.

The satin weave when used in producing linen fabrics gives damask, and when used with mercerized cotton it gives sateen. In this class of fabrics more than half of the warp, or lengthwise threads, show on the face of the goods, completely covering the weft, or crosswise threads. When ironed or calendered with heavy pressure, the fabrics have a smooth, shiny surface.

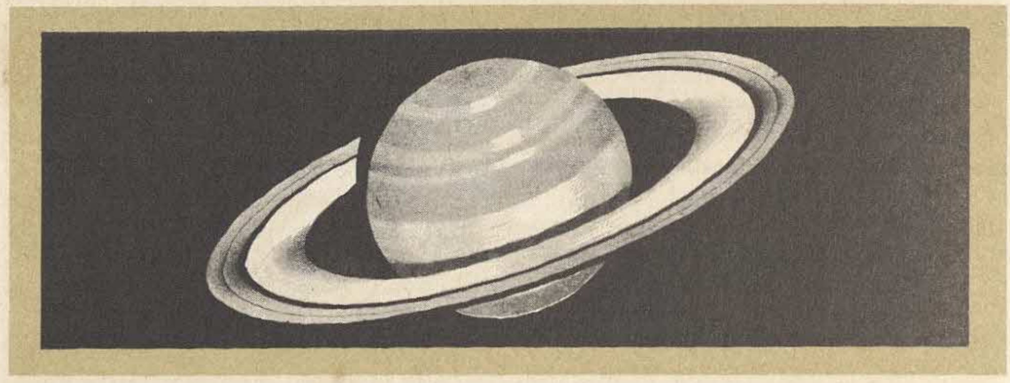
Double-faced satin is made with two sets of warp, usually of different colors, and one weft, and has a satin surface on both sides of the goods. This is most often seen in heavy satin ribbons. *Brocaded* satin is a silk fabric having designs or figures formed of raised threads upon a satin background. A lightweight satin is called *messaline.*

Satin is used for dresses, linings, trimmings, etc. Its usual width is from twenty-seven to thirty-nine inches. Formerly, gentlemen's clothes were made from it.

SAT′URDAY. The last day of the week is the only one which, in the English language, is named for a god of ancient Rome. Saturday is *Saturn's Day,* in England and America, but, strangely enough, not in Rome. There it is *Sabbato,* the Sabbath.

As it is the seventh day of the week, Saturday has always been held by the Jews as a day of rest, but in Christian countries Sunday has generally taken its place.

SAT′URN. One of the earliest of the gods, Saturn is known in Roman legend as the father of Jupiter, Neptune, Pluto, Juno, Vesta, and Ceres. According to the ancient myth, Saturn drove his father, Uranus, from the throne. Fearing a prophecy which said that one of his own children would depose him, Saturn swallowed his children as they were born. But Jupiter was saved by his mother, who later forced Saturn to give up all the children he had swallowed. Jupiter then deposed Saturn, who founded a prosperous kingdom in Italy. Saturn is shown in art as Father Time. He was also the Roman god of agriculture, and the Romans celebrated the feast Saturnalia in his honor.



THE LIGHTWEIGHT PLANET

Saturn is the least dense of the planets and appears to be composed of vapor. In spite of its size, its gravitational pull is not much greater than that of the earth.

SATURN. Whirling in space 886,000,000 miles from the sun, the planet Saturn is sixth in order from the sun and the second largest body in the solar system. Saturn is composed largely of gaseous matter. Thus, although it is 730 times as large as the earth, its mass is only ninety-five times greater than that of the earth and its density one eighth that of the earth.

The most striking feature of Saturn is the system of flat, cloudlike rings which surrounds it. These rings are composed of a great number of minute particles. The outer ring is about 10,000 miles wide and 100 miles thick, and its diameter is about 171,000 miles. There are also two wide inner rings. Saturn also has nine satellites, the largest of which is Titan, about 2,600 miles in diameter.

The planet has a yellowish tinge. Saturn rotates on its axis once every ten hours, and makes one complete revolution around the sun in 29.46 years.

For further information, consult the following articles:

Astronomy
Planet
Satellite
Solar System

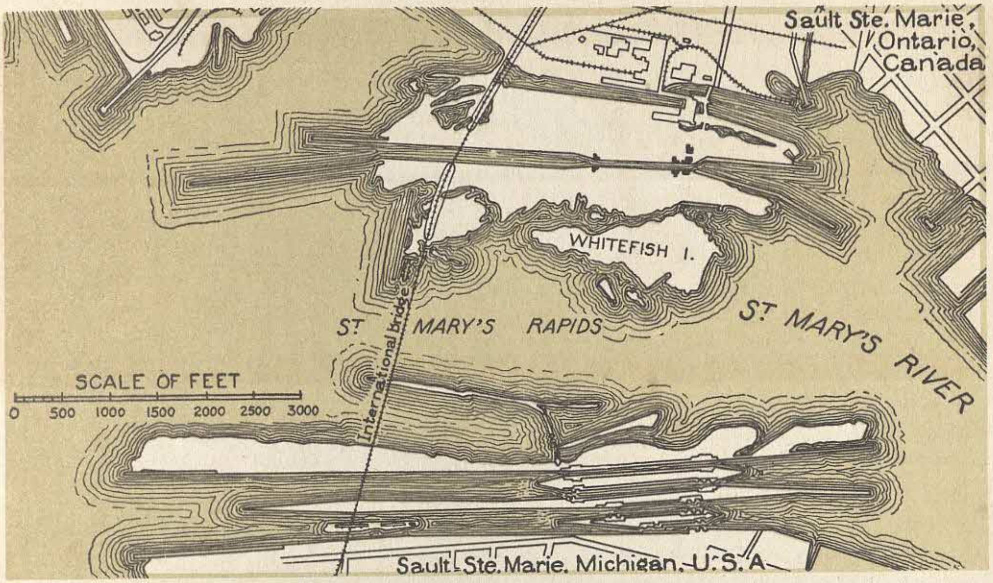
SATYRS, *sat'urz.* Half man, half goat, the satyrs were weird creatures of the woods, according to classic mythology. Bacchus, the god of wine, was usually associated with the satyrs, of whom Pan was the chief. The satyrs usually were depicted with horns on their heads, hairy bodies, and the feet and tail of a goat. See MYTHOLOGY; PAN.

SAUL. Reigning in the eleventh century B. C., Saul was the first king of Israel. Saul was anointed king by Samuel, the last judge of Israel. He was instrumental in uniting the tribes and gained many victories over the enemies of the kingdom, particularly the Philistines. The story of Saul's reign is given in *I Samuel* of the Bible. See BIBLE STORIES.

SAULT, *soo,* **SAINTE MARIE CANAL, or SAINT MARY'S CANAL.** Because of the rapids in the Saint Mary's river, which connects Lake Superior and Lake Huron, a system of canals has been built, in Michigan and the province of Ontario, to accommodate Great Lakes traffic.

These canals are among the most important artificial waterways in the world, for statistics show that the tonnage passing through them each year exceeds the combined tonnage through the Suez, Panama, and New York State Barge canals. The story of these canals goes as far back as 1798, when a fur company dug a ditch on the Canadian side of the Saint Mary's of sufficient width to permit canoes to ascend the river. This ditch was equipped with one lock, with a lift of nine feet, but it was destroyed by American soldiers in the War of 1812.

In 1855 the state of Michigan completed the first Sault Sainte Marie Canal, which



BUSY CANAL
The world's most-traveled commercial artery for ships, the Sault Sainte Marie system can handle up to 100 vessels a day during the eight-month navigation season. Its location takes its name from the French for *leap;* the river falls twenty feet here in less than a mile. Right, a typical ore boat in one of the locks.

twenty-six years later it turned over to the Federal government. This canal had two locks, each 350 feet long, and each had a lift of nine feet. These locks were later destroyed in excavating for a more modern one, the 515-foot Weitzel Lock, which was completed in 1881. The Weitzel, in turn, was replaced in 1943 by the MacArthur Lock, named in honor of General of the Army Douglas MacArthur; it is 800 feet long and has a minimum depth of thirty-one feet, making it the deepest of the four American locks. North of the MacArthur is the Poe Lock, completed in 1896; it is 704 feet long.

The old canal channel was but 108 feet wide; in 1908 the government began widening it to 230 feet, and at the same time began the construction of a third lock, called the Davis, which was completed in 1914. This was a remarkable lock because it was the longest in the world, being 1,350 feet between the inner gates. In 1912 Congress authorized the construction of a fourth lock, north of the Davis and exactly similar to it. It was opened in 1919, and is called the Sabin.

The first Canadian ship canal on the Saint Mary's was begun in 1888, and completed seven years later at a cost of $5,000,000. It is one and one-third miles long, 150 feet wide, and twenty-three feet deep.

The lock is 900 feet long and has a lift of eighteen feet.

The great tonnage passing through this system of canals is composed of vast shipments of iron from the Lake Superior region, wheat from Northwestern United States and the prairie provinces of Canada, and lumber. See CANAL; LOCK.

SAUSAGE, *saw'sayj.* Minced (finely chopped) meat which contains seasoning is classed as sausage. Pork sausage is generally considered to have the finest flavor, but many varieties contain beef, liver, veal, or chicken. Packing-house sausage consists of meat mixed with potato flour, to which is added the proper amounts of salt, pepper, sage, ginger, mustard, or other seasoning. Such sausage may be of two kinds, bulk or link. Link sausage is made by cleaning the intestines of the slaughtered animals, stuffing them with the meat, and tying them into links. Sausage casings are now made artificially from cellulose, as well as from animal intestines. Homemade sausage is usually in bulk form and consists entirely of meat.

In addition to regular pork sausage, there are many foreign varieties now commonly made in the United States. *Wienerwurst* was originally made in Vienna; *frankfurters* were first made in Frankfort, Germany; and *Bologna* originated in the Italian city of Bologna. All these varieties are highly seasoned. *Summer* sausage, *liverwurst,* and *head cheese* are other popular sausages.

SAVINGS BANKS. Almost everyone has used the facilities of a savings bank at some time. Savings banks are institutions which receive money from depositors and lend money to organizations and individuals. Interest is charged on the loans, and interest is paid to the depositor for the use of his money. The difference in the rates of interest, that charged for loans being higher than that paid out for deposits, provides for the maintenance of the bank. By means of savings banks, money is kept flowing in the channels of trade instead of being hoarded, and the owner of the money is able to increase his wealth from time to time.

Courtesy Rand McNally Bankers' Monthly

GUARDIAN OF CASH AND CREDIT

The savings bank is a stabilizing and business-building force in the present-day community.

There are two classes of special savings banks in the United States, in addition to the savings departments maintained by most commercial banks. They are *mutual* banks owned by the depositors and *stock* banks owned by stockholders. Most banks in the United States today protect the deposits of their clients, up to $10,000, with insurance under the Federal Deposit Insurance Corporation.

The first savings bank was founded at Brunswick, Germany, in 1765. At first, savings banks were organized for the safekeeping of valuables. They are still used partly for that purpose, modern savings banks maintaining safety-deposit vaults.

Postal Savings Banks. The first postal savings banks were organized in England in 1861, but the United States did not adopt the system until 1910. Postal savings banks

PREACHING AGAINST CORRUPTION

For about six years, Girolama Savonarola was virtual dictator of Florence and watched over that city's political and moral welfare with the greatest of zeal.

are operated in conjunction with post-office departments for the purpose of discouraging hoarding, encouraging savings, and keeping money in circulation.

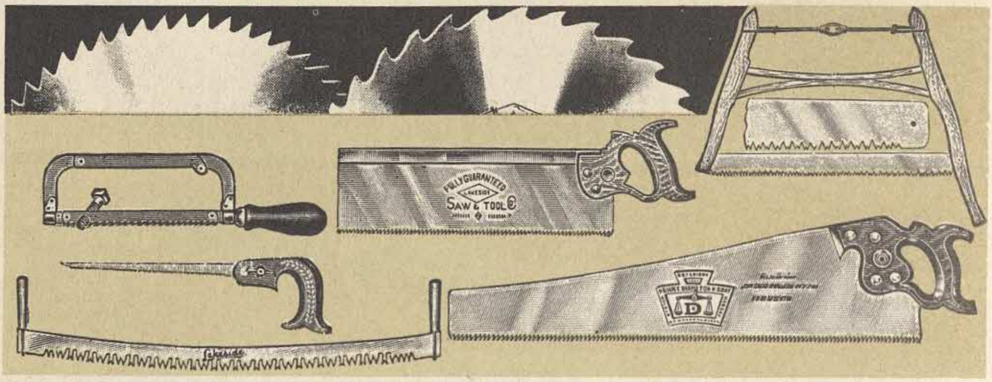
In the United States a postal savings account may be opened by anyone over ten years of age upon deposit of one dollar. Interest is paid at the rate of two per cent a year. No depositor may have more than $2,500 in postal savings; when he has acquired this amount, he is encouraged to buy postal savings bonds.

Postal savings have proved to be a reliable form of savings. Deposits in the United States have varied from $65,000,000 to more than $2,725,000,000.

School Savings Banks. Valuable from the standpoint of teaching the methods and benefits of savings to boys and girls, school savings banks have existed in the United States since 1885; they were in existence fifty years earlier in Europe. According to most plans, students deposit their money with the school, which then places the money in a regular savings bank. When the pupil has a dollar or more on deposit, an individual account is opened for him directly with the bank. Millions of dollars have been saved by school pupils since the adoption of school banking plans.

SAVONAROLA, *sav o nah ro' lah,* GIROLAMO (1452-1498). Almost single-handedly, Girolamo Savonarola fought a long and relentless battle against the lax morals and corruption of both Church and political life in Italy's Renaissance period. He met with considerable success during the early part of his career, but the enemies he aroused were powerful, and eventually brought about his downfall.

Born in Ferrara, Savonarola joined the Dominican Order of monks and entered the monastery at Bologna, where he became a respected and admired teacher. He began his preaching at Ferrara in 1482, but it was when he went to Florence in 1490 that he began to attract notice. He won a great following, but also created powerful



KEEN-CUTTING BANDS OF TEETH

Here are some typical saws. Left to right, top, crosscut and rip circular saws, bucksaw. Center, hacksaw, backsaw. Bottom, felling saw, keyhole saw (above), and carpenter's handsaw.

enemies because of his opposition to the Medicis, who had taken over the rule of the city republic. His efforts to reform the Church also met with resistance from authorities. In 1494 the monk rendered valuable service to Florence when he persuaded Charles VIII of France, who attacked Florence, to spare the city.

Savonarola's belief that he could foretell the future was one of the important factors which led to his downfall, since it lost him much of the confidence of his people and also because it angered the Church and political authorities. In 1497 he was excommunicated by Pope Alexander VI, and a year later was imprisoned. Six weeks after his arrest, Savonarola was executed.

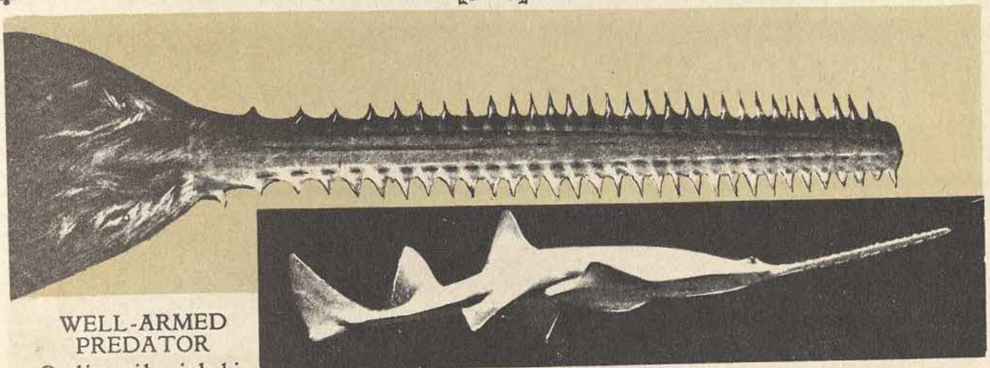
SAVOY, *sah voi',* HOUSE OF. The House of Savoy was the oldest royal family in Europe when, in 1946, its long reign came to a close. It originated with Humbert, first Count of Savoy, who died in 1056. After 1416, members of the house were known as the Dukes of Savoy; after 1720 as kings of Sardinia; and after 1861 they were known as kings of Italy. See ITALY.

SAW. Consisting of a steel band edged with sharp teeth, the saw is a valuable and important tool to the carpenter and the metal worker. There are two general types of saws, *crosscut* and *rip*. Crosscut saws, which are used to cut across the grain of the wood, have triangular teeth, sharpened on both sides to a very sharp point. The teeth of the rip saw, used to cut wood lengthwise, or with the grain, are set alternately slanting and straight, so that the cut is wider than the blade. They are sharpened to a chisel-like edge.

Other types of saws are the *circular machine* saws, used in varying sizes in sawmills; *band* saws, which are stretched across two pulleys like a belt, and are used in fine furniture work; *compass* saws, which have very narrow blades and are used to cut along curved lines; *bucksaws,* thin-bladed and used for cutting wood; and the *hacksaw,* made of very hard steel and used for cutting metals and other similar materials.

SAW'FISH. Usually found only in the tropical waters of Japan, Australia, and Central America, the sawfish is one of the ocean's most vicious killers. This gruesome member of the ray family, which may reach a length of fifteen feet, occasionally wanders north as far as the New Jersey coast. The fish is armed with a long, swordlike snout, heavily spined on both edges. The sawfish attacks fiercely, tearing open its prey with the snout. It later devours it in the rough, flat-toothed mouth on the underside of its body.

SAXIFRAGE, *saks' i frayj.* This early spring flower grows on rocky ledges and along moist banks. It forms a delightful addition to the rock garden, with its dainty little white flowers, which are replaced by attractive, brownish-purple fruits. The



WELL-ARMED PREDATOR

Ordinarily inhabitants of warm seas, big, sluggish sawfish are rather common in the waters off Florida and in the Gulf of Mexico; rarely, one is taken in the North Atlantic path of the Gulf Stream.

name is of Latin derivation and means *rock breaker*. The plant is commonly supposed to cause the breaking up of the rocks, because it grows abundantly in the rock crevices. The saxifrage is too frail, however, to make much impression on the rocks.

SAX'ONS. In Northwest Germany and in England there live today many descendants of the ancient Saxons. A warlike people, they sailed from the continent in the fifth and sixth centuries and invaded Britain, where they founded a kingdom. Many, however, remained in the land we call Saxony and were later conquered by Charlemagne and forced to adopt Christianity. See ENGLAND.

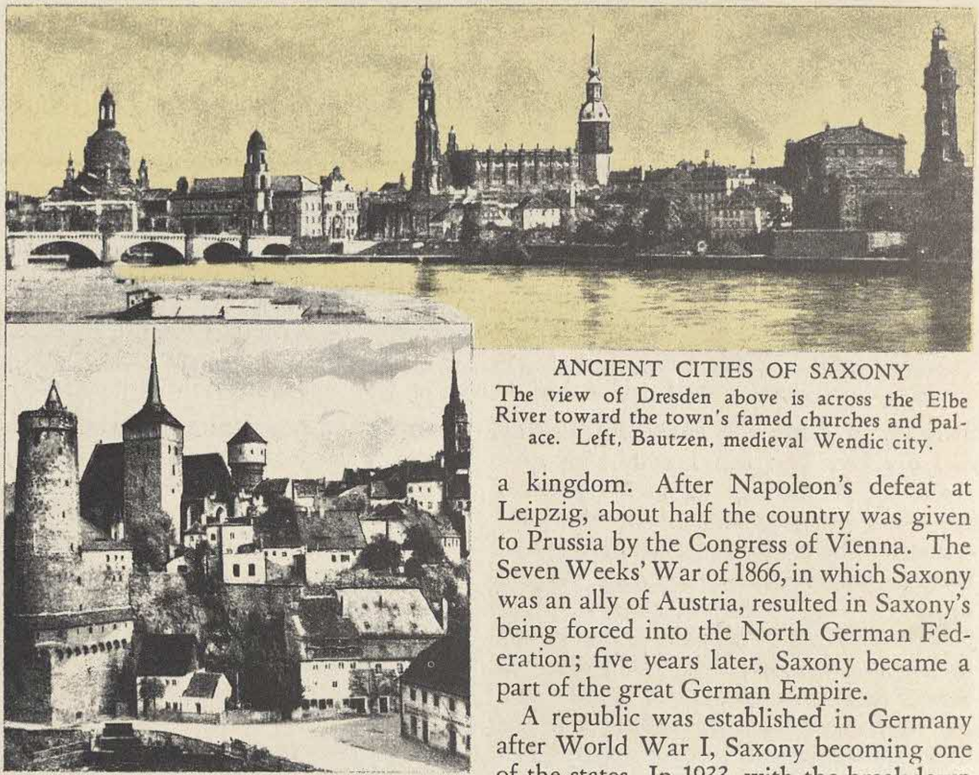
SAX'ONY, a region and former state of Germany, is now part of the German Democratic Republic of East Germany. The Erzgebirge (Ore mountains) on its eastern border separated it from Czechoslovakia. Its area was about 5,785 miles. Largest cities of this region are Leipzig, Dresden, Chemnitz, and Plauen. The Elbe River flows through this region on its way to the North Sea at Hamburg.

Saxony is rich in coal, iron, silver, tin, and other minerals; and mining and metal working rank second only to the textile industry. Agriculture is important, potatoes and cereals being the leading crops. About one fourth of Saxony is timbered. Meissen is famous for the manufacture of Dresden china. Before Germany's defeat in 1945, Leipzig was her leading publishing center.

History. Named for the Saxons who originally dwelt here, Saxony fell into the hands of the Franks under Charlemagne in the eighth century (see CHARLEMAGNE). In the ninth century the region was divided into marks in order to protect the people against the attacks of the Slavs and Norse-

SAXON INDUSTRIAL CENTER

Chemnitz thrives on metal, textile industries.



ANCIENT CITIES OF SAXONY

The view of Dresden above is across the Elbe River toward the town's famed churches and palace. Left, Bautzen, medieval Wendic city.

men. Over each mark ruled a duke, one of whom took over the control of the entire area, thus establishing the old Duchy of Saxony. And so it remained until 1423, when the ruler of Saxony became the elector of Saxony.

In the sixteenth century, while Saxony was under the rule of Frederick the Wise, the Reformation broke out. At this time, under the leadership of Martin Luther, Protestantism became, and still remains, the dominant religion. Saxony, however, lost its position as the leading Protestant state in the Thirty Years' War (see THIRTY YEARS' WAR). In the seventeenth century Saxony joined Poland and Denmark in a war of aggression against Sweden, a struggle which crippled the finances of Saxony.

The War of the Austrian Succession, in which Saxony participated, completed the wrecking of the country's money system. In 1806 Saxony joined Napoleon in his conquests. In the same year Saxony became a kingdom. After Napoleon's defeat at Leipzig, about half the country was given to Prussia by the Congress of Vienna. The Seven Weeks' War of 1866, in which Saxony was an ally of Austria, resulted in Saxony's being forced into the North German Federation; five years later, Saxony became a part of the great German Empire.

A republic was established in Germany after World War I, Saxony becoming one of the states. In 1933, with the breakdown of the republic, a totalitarian form of government was set up under Adolf Hitler. Saxony was merely an administrative unit of the German Reich until Germany's defeat in 1945. See GERMANY.

SAXOPHONE, *sak' soh fone.* This musical instrument has a curved conical tube with keys, and a single-reed mouthpiece. It was invented about 1840 by Antoine Joseph, known as Adolphe Sax, a Belgian who was responsible for many improvements in various musical instruments.

The peculiar tone quality of the saxophone has made it a very valuable addition to bands and orchestras. It is popular also as a solo instrument. Comparatively unknown outside of military bands, it leaped into sudden prominence when its special suitability to "jazz" rhythms was discovered. Many saxophone quartets have been formed, both amateur and professional. Players of the flute, oboe, or clarinet can quickly master the saxophone, because the

Courtesy C. G. Conn Ltd.

EASY-TO-LEARN INSTRUMENT

The saxophone is among the easiest of modern band instruments to learn and has therefore proved widely popular. Left, the original saxophone. Right, the modern saxophone.

fingering is similar to that of the flute and oboe, and the mouthpiece is like that of the clarinet. The instrument is made in several sizes.

SCALE. The basis of all music is the scale, a series of successive tones arranged in order of pitch. The simplest scale consists of seven tones, arranged upward in regular order from a base note, called the *tonic,* or *keynote.* An eighth tone, which is the same as the first but an octave higher, is added to complete the octave. For example, when C is the tonic, the scale includes C, D, E, F, G, A, and B. The second C is added to make the octave. The chromatic scale consists of twelve successive half tones, all arranged upward from a tonic. For example, starting with C, the chromatic scale includes all the half tones between the first C and the next C.

A scale is called *major* when the half tones occur between the third and fourth and between the seventh and eighth notes; a scale is called *harmonic minor* when the third and sixth notes are shifted down a half tone. See Key; Music.

SCALES. A number of different kinds of animals have on their bodies thin, hard plates which we call scales. But in no two are the scales alike. In some cases they are thin plates of bone; in others, layers of horn that are really modified hairs. On some animals, including butterflies, they overlap like shingles. On others, including crocodiles, they are separated by soft spaces. For most animals, scales serve merely as protection, but butterfly scales also carry the pigments which give the wings their beautiful patterns, and the scales of fish make swimming easier.

Fish scales are bony and grow from the lower layer of skin. In some fishes the bone is covered by an enamel or a smooth substance called *ganoin.* Crocodiles, lizards, and other reptiles have scales that grow from the outer layer of skin, and are horny instead of bony. When these are large and do not overlap they are called *shields.*

SCALES FOR WEIGHING. See Weighing Scale.

SCALLOP, *skol'up.* Closely related to the oyster is the scallop, a bivalve mollusk with a fanlike shell, found off the coast of both Europe and America. There are two important types, the *common* and *great* scallops. The shell is hinged, and the animal moves about on the sea bottom by opening and closing its shell. The muscular hinge is edible and scallops are found in the fish markets. Scallop shells were worn in the hats of Crusaders during the Middle Ages. Today they are used as decorations and are often ground into "shell" for poultry.

SCANDINA'VIA. Although it no longer has any political significance, the term *Scandinavia* is used to designate Norway, Sweden, Denmark, and Iceland. The peninsula occupied by Norway and Sweden is called the Scandinavian Peninsula. See Denmark; Norway; Sweden.

SCARAB, *skair'ab.* Because the early Egyptians thought the scarab resembled the sun in shape and luster, this beetle became a symbol of immortality and was considered sacred. As a result, the scarab was widely used as a decorative motif on buildings and in all types of personal ornaments. The scarab is also called the *dung beetle* from its habit of rolling bits of refuse into pellets for food.

SCHELDT, *skelt.* One of the leading commercial waterways of Europe is the Scheldt River, which rises in the Aisne region of France, flows northeasterly through Belgium, and enters the North Sea in the Netherlands. The river is over 250 miles long. It is connected by a series of canals with several of the cities of France and Belgium, and a number of locks make it navigable for more than 200 miles. At the city of Antwerp, in Belgium, it is wide enough to accommodate the largest ocean vessels. Below Antwerp, as it enters the Netherlands, the islands of North and South Beveland and Walcheren split it into two branches, the East and West Scheldt.

Beginning in 1648, under the Treaty of Munster, the Dutch controlled the commerce on the Scheldt for over 200 years, and from 1839 assessed toll charges on all foreign boats on the river. Since 1863 the river has been open and free to all nations, except in time of war.

SCHILLER, *shil'ur,* JOHANN CHRISTOPH FRIEDRICH VON (1759-1805). Immortal literature, nearly on a par with that of Goethe, was the contribution of Johann Christoph Friedrich von Schiller, German poet, historian, dramatist, and philosopher.

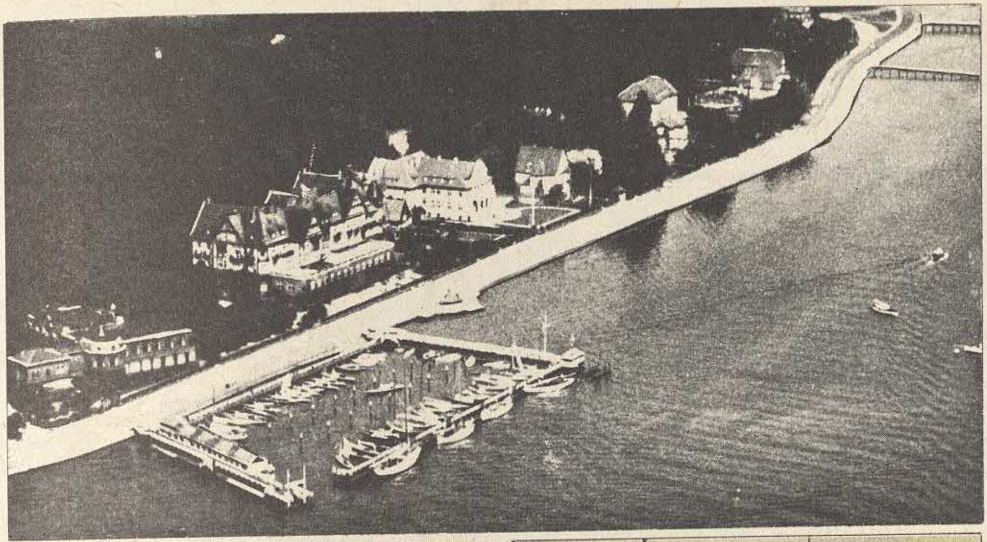
Born in Marbach, Württemburg, Schiller was educated there at the military academy of Duke Karl of Württemburg, studying law and, later, medicine. Secretly, he began writing a play, *The Robbers,* which was intended as a protest against the political system common in Germany at that time. Having been graduated from the duke's school, Schiller became a military surgeon in Stuttgart, where he had his play printed. It was produced with success the following year in Mannheim.

Schiller was forbidden to write any more plays, but he fled to Mannheim, where he wrote two others—*The Conspiracy of Fiesco* and *Cabal and Love.* Later, in Dresden, he wrote his *Ode to Joy,* which Beethoven set to music; and in Weimar he completed *Don Carlos,* a play that was produced in Leipzig in 1789 with great success.

SCHILLER AT WEIMAR
The poet reading to the Court and Goethe.

In 1788 Goethe secured for Schiller the position of professor of philosophy at the University of Jena, and for ten years Schiller wrote constantly. Then, in 1798 and 1799, his great dramatic trilogy of the Thirty Years' War, *Wallenstein,* was produced. Today, it is regarded as the finest stage drama ever written by a German. *Wilhelm Tell, Maria Stuart, The Maid of Orleans,* and *The Bride of Messina* followed, among other works. During the latter years of his life, Schiller enjoyed the close friendship of Goethe, although previously they had been estranged because of Schiller's criticism of the master's *Egmont.*

The best known of Schiller's poems include *The Diver, The Cranes of Ibycus, The Glove,* and *The Song of the Bell.* Schiller died in Weimar three years after he had been raised to the nobility.



GERMANY'S BALTIC NORTHLAND
Above, a park in Kiel, which skirts the shore of Kiel Fiord. Until 1945, Kiel was headquarters of Germany's naval commander in chief and of the Baltic fleet. Right, old episcopal palace in Eutin.

SCHLESWIG-HOLSTEIN, *shles' wig hole' stine,* is a state in the Federal Republic of Germany. Schleswig-Holstein has played an important part in European history. It lies just south of Denmark, between the Baltic and the North seas. A large part of the state is low moorland, and the west coast is sandy and marshy. The southern section is famous for Holstein cattle. The state has an area of 6,044 square miles, and a population of about 2,276,000. At one time the duchies of Schleswig, Holstein, and Lauenburg were located in this region.

History. In the eleventh century Schleswig was ceded to Denmark, after being under German rule for many years. About a century later it was made a Danish duchy. In the latter part of the fourteenth century, the Count of Holstein became the ruler. Upon his death Schleswig and Holstein asked the Danish king, Christian I, to be their ruler, upon the condition that he would never separate them or make them a part of Denmark. This was rather a strange request, for the people of Schleswig were chiefly Danish, and those of Holstein were German. In 1848, however, the ruler of Denmark broke this pledge when he attempted to incorporate Schleswig into Denmark. Rebellions followed, in which the people received Prussian aid. Denmark was defeated.

In 1864 Prussia (under Bismarck) and Austria asked Denmark to withdraw from

Building Futures

SCHOOLS, HOPE OF MANKIND

Left, Canadian students work out their own physics experiments. Right, phonics and word games are used in New York City reading clinic.

Nat. Film Board of Canada; Wide World

Schleswig-Holstein; and when this request was refused, war was declared. Denmark was defeated. Prussia took control of Schleswig, and Austria ruled Holstein. Austria and Prussia soon came into conflict over the management of the two duchies, and Bismarck cleverly used this disagreement to foment war between Austria and Prussia. In the Austro-Prussian War of 1866, Austria was defeated, and Schleswig-Holstein was joined to Prussia.

The two sections remained a part of Germany until after World War I. In 1920, under the terms of the peace treaty, the people of Schleswig-Holstein were allowed to decide by vote whether they were to belong to Germany or to Denmark. As a result of the vote, the northern part of Schleswig went to Denmark; the rest of the territory remained with Germany. See GERMANY; SEVEN WEEKS' WAR; WORLD WAR (I, II).

SCHOOL SAVINGS BANKS. See SAVINGS BANKS.

SCHOOLS. The future of civilization rests largely upon our schools. In a broad sense, any place where instruction is given, whether it be vocational, technical, artistic, or scientific, may be classified as a school. In a more restricted sense, the term applies only to those institutions below college rank. Of these schools, the common and high schools, both government-supported, are the most important.

Kinds of Schools. The school system of the United States is composed of common schools, secondary schools, colleges, and universities, and various branches such as trade, vocational, evening, and correspondence schools.

Our Basic Education—The Common School. Even in colonial days, the public school was a highly important institution. It was then closely associated with the Church and largely supported by subscriptions, bequests, and tuition fees. Such schools could not be classified as free public schools, for not all children could afford to attend regularly. As time went on, the influx of immigrants of varying faiths, the extension of suffrage, and the demand of the working classes for equal educational opportunities for their children made the

TRAINING COLLEGE

Church-dominated school impractical, and state-supported schools were instituted. One of the earliest provisions for this new system appeared in the Ordinance of 1787, which provided for the establishment of free public schools in the territory north of the Ohio and east of the Mississippi.

The common schools of today are, in most states, controlled by the local school board, the state, and some unit (such as the county) between the state and the local community. In most communities the members of the board of education are elected, although in larger cities they are often appointed by the mayor. It is the board's duty to select the teachers, to determine, in part, the curricula, to plan finances, and otherwise to regulate the schools through the medium of the local superintendent.

Intermediate control is usually exercised by the county superintendent, although in some states two or more counties may be combined for school purposes. At the head of the state school system is the commissioner of education, or superintendent of public instruction, who, in many states, is assisted by a state board of education in formulating state educational policies and providing standard courses of study.

The three most important problems of any public-school system are compulsory attendance, free instruction and equal educational opportunities for all. In most districts, free textbooks are also provided. All states require school attendance, usually from the ages of six to sixteen. Minimum school terms vary from three to nine and a half months. Adult educational facilities and, in rural areas, the establishment of consolidated schools are recent advances in education. Consolidated schools take in students from miles around, giving them the advantages of large city schools.

Just as the control of the public schools is divided among three governmental units, so, too, are the finances provided. Local and county support is provided by general taxation; the state's share is taken from its annual income. The percentage each contributes to the school system varies widely in the different states.

Importance of the Common Schools. Between 1900 and 1950 the number of American young people from five to seventeen who were not attending school was cut in half. The main purpose of the public schools today is to give to all pupils those courses that will be of most value throughout life. The "three R's," grammar, geography, history, and civics, as well as domestic science and manual training, have long been considered essential courses. To these subjects are added art, music, machine-shop work, and a host of others of a vocational and elective nature. The standards of schools and teachers are constantly being raised, and the progressive common school today bears little resemblance to that of a generation ago.

Further Training. An ambitious student, after finishing common school, has a choice of two paths to pursue. He may elect vocational work in a trade, commercial, or scientific school; or he may continue through high school and on to college. In either case he will find awaiting him at the end of his school career better opportunities than would be his with less school training. See COLLEGES AND UNIVERSITIES; EDUCATION; HIGH SCHOOL.

SCHUBERT, *shoo'behrt,* FRANZ (1797-1828). The life of Franz Schubert, an Austrian composer who holds a high place in the musical world, may be likened to a meteor that appears suddenly in the sky, flames brilliantly, then is swiftly snuffed out. This amazing genius lived only thirty-one years, yet in that brief time he wrote more than 600 songs, nine symphonies, fourteen string quartets, an oratorio, six masses, seventeen operas, and a host of other instrumental and vocal works.

A native of Vienna, Schubert received comparatively little musical training, but as a youth he was turning out the superbly melodic art songs that made him the unquestioned master of this form of music. When he was but nineteen he composed *The Erlking* and *The Wanderer,* two songs

MUSICAL GENIUS
His mind rich with melody, Franz Peter Schubert wrote an amazing number of musical compositions. All his life he was penniless, but friends helped him, were rewarded by being the first to hear his songs (right).

that have made the name of Schubert known everywhere. Of deathless fame, too, are his *Serenade, Hark, Hark, the Lark,* and *Who Is Sylvia.*

Schubert's entire life was one of poverty and disappointment, and often his scores sold for as little as twenty cents. The second act of one of his operas, *Des Teufels Lustschloss,* was lost to the world forever because a servant of a man to whom Schubert had given the score in payment for a small debt used it to light a fire. Mystery surrounds the famous and charming *Unfinished Symphony,* which contains only the first two movements and nine bars of a third. No one knows what became of the remainder of the work, or if it was ever written. A lovely operetta, *Blossom Time,* is based on Schubert's life; the score is in part an adaptation of this symphony.

Perhaps the only solace in the brief and tragic life of Schubert was his ability to make friends. His admirers never lost faith in him, and despite the neglect which the musical world displayed toward him during his lifetime, he was consoled by his work and companions. Schubert died just as he was about to commence the study of counterpoint.

SCHUMANN, *shoo'mahn,* ROBERT (1810-1856). Even if Robert Schumann had never written any compositions, his name would be an honored one in music. For it was he who brought to light the genius of Schubert, Berlioz, and Mendelssohn, and "discovered" Chopin and Brahms.

The son of a bookseller and publisher of Zwickau, Saxony, where he was born, Schumann was sent to the University of Leipzig in 1828 to study law. His interest, however, was in the piano, which he had learned to play skillfully as a youth, and he turned to music for a livelihood. Denied a career as a performer by an injury to a finger, he became a composer and critic, founding the *Neue Zeitschrift für Musik,* a publication in which he encouraged the work of other artists.

Schumann is best known for his piano compositions. His romantic songs and four symphonies also are played often, and an excellent violin concerto of his was performed for the first time in 1937. During the latter years of his life he was subject to

COMPOSER CRITIC
In Robert Schumann, literary and musical genius were fused in an exceptional manner. The memorial room in Zwickau (right) is preserved in the city where the composer was born.

fits of melancholy, and he died in 1856, after two years in an asylum. He was survived by his wife, Clara Wieck Schumann, an outstanding pianist of the nineteenth century.

SCHURZ, *shoorts,* CARL (1829-1906). A liberal whose advanced views forced him to leave his native Germany, Carl Schurz became an important political leader in his adopted country, America.

Schurz was born in Liblar, Prussia, and received his education in Cologne and at the University of Bonn. In 1848 he left Germany and in 1852 came to the United States, settling in Wisconsin. He became a leader of the newly formed Republican party and supported Lincoln. Schurz was appointed minister to Spain as a reward, but in 1862 he resigned to join the Union army, seeing service at Chancellorsville, Gettysburg, Bull Run, and Chattanooga.

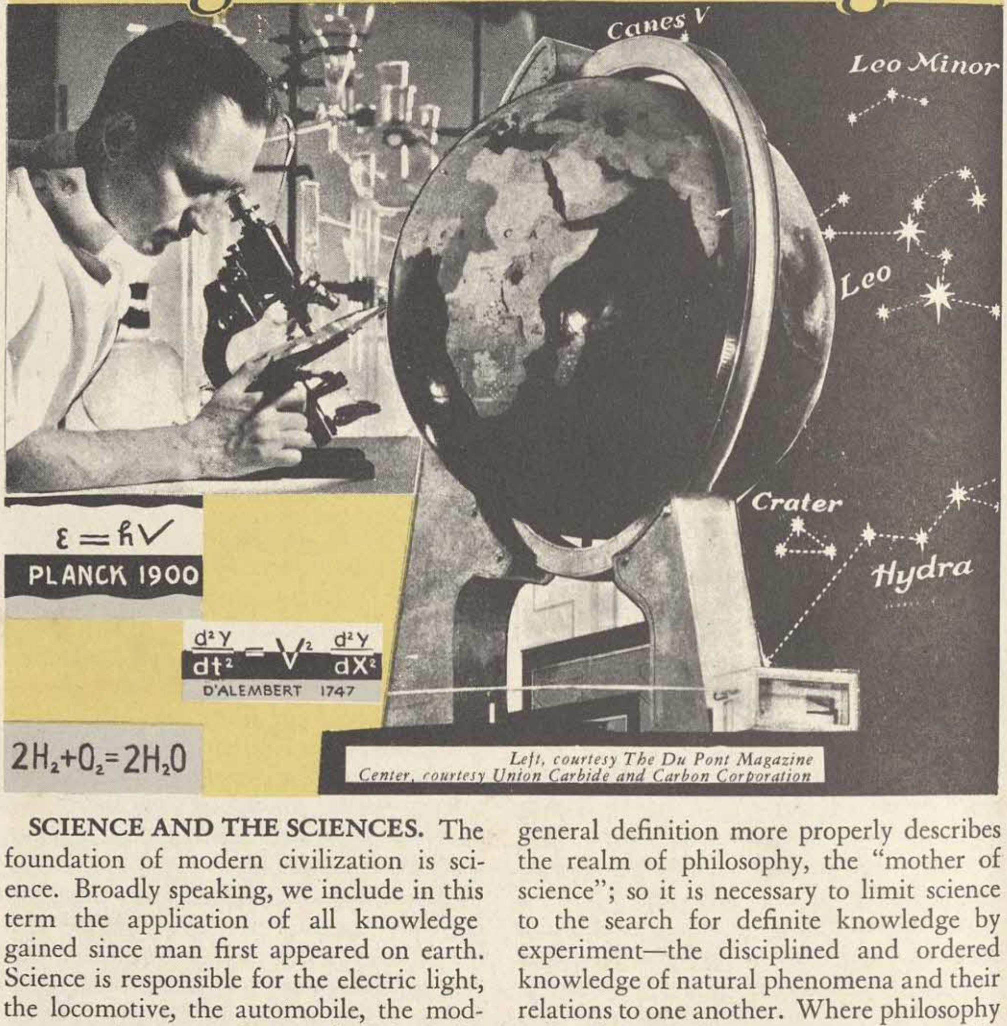
After the war he turned again to newspaper work, and later became editor of the Saint Louis *Westliche Post,* a German daily. His election to the United States Senate in 1869 was followed by his appointment by President Hayes as Secretary of the Interior. After the close of the administration, Schurz continued as a leader of reform, especially in behalf of the civil service. He supported two Democratic leaders, Cleveland and Bryan.

SCHUYLER, *ski'lur,* PHILIP (1733-1804). An able general, Philip Schuyler made his outstanding contribution to the success of the American Revolution when he helped defeat Burgoyne at Saratoga (see SARATOGA, BATTLES OF). Born in Albany, N. Y., Schuyler gained military experience in the French and Indian Wars, and in 1775 was sent to the Continental Congress. Shortly after the Battle of Bunker Hill, he was appointed major general in command of the Northern New York division of the Continental Army. In this capacity he fought the Indians and Tories of New York and concluded an alliance with the Six Nations.

Hindered in his plans by his superiors, Schuyler resigned his commission, but it was not accepted. He remained in the army, although he was replaced by General Gates. Schuyler later held many state offices, and was a member of the Senate.

SCHUYLKILL, *skool'kil.* An important source of water supply to Philadelphia is the Schuylkill River, which rises in the highlands of Northeastern Pennsylvania. The river follows a southeasterly course for about 120 miles to the Delaware River, which it joins below Philadelphia. The Schuylkill is navigable in its lower course for coal barges and boats of light draft, has been improved by dams and locks, and supplies hydroelectric and water power for factories nearby.

Organized Knowledge



Left, courtesy The Du Pont Magazine
Center, courtesy Union Carbide and Carbon Corporation

SCIENCE AND THE SCIENCES. The foundation of modern civilization is science. Broadly speaking, we include in this term the application of all knowledge gained since man first appeared on earth. Science is responsible for the electric light, the locomotive, the automobile, the modern operating room, the cure for rabies, the research laboratory, and the sanitary dairy, to name only a few of the thousands of things that make up our modern life. But science has also given man artillery, the torpedo, the atomic bomb, and other destructive forces. Like fire, it is a benefactor to mankind when properly used, yet an enemy when improperly used.

The word *science* comes from a Latin word meaning *to know;* and according to that derivation, science might be said to imply the search for knowledge. Yet this general definition more properly describes the realm of philosophy, the "mother of science"; so it is necessary to limit science to the search for definite knowledge by experiment—the disciplined and ordered knowledge of natural phenomena and their relations to one another. Where philosophy is based upon what man reasons out without full proof, science is specific and accepts only those facts that can be proved. By this definition, science includes such studies as mathematics, physics, astronomy, chemistry, zoölogy, botany, physiology, anatomy, anthropology, bacteriology, geology, and physical geography.

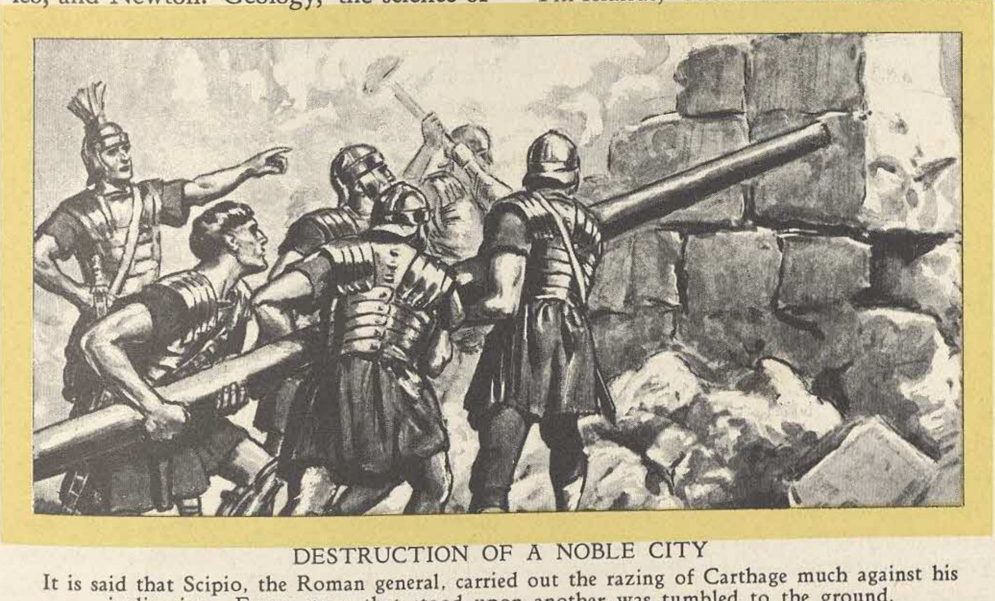
Science had its faint beginnings with primitive man's first observations, presumably of the heavenly bodies, and his mastery over tools and implements to gain security and comfort in his life. He also observed the plants and the animals that were useful to him and studied them accordingly. Thus his domestication of animals, use of the hatchet and knife, cultivation of crops, and religion based on the stars, the moon, and the sun were scientific accomplishments, although he surrounded his religion with a mysticism and ceremonial that were not scientific. Based on these observations, the most ancient sciences were astronomy, the science of the heavens; biology, the science of living matter; and mechanics, a branch of physics.

The Greeks had no classification of sciences until the time of Aristotle but studied them all (see ARISTOTLE). They gave the greatest impetus to scientific study by developing the methods of approach. Geometry, for instance, is the best example of deductive reasoning, absolutely necessary to science, and it was a Greek invention. After the Renaissance, science branched out still more. Physics received its impetus with the use of inductive reasoning by Bacon, Galileo, and Newton. Geology, the science of the earth, came to be a separate science in the eighteenth century; physiology, the study of the life functions of animals and plants, became a separate field of study a century earlier.

For additional information, consult the following articles:

Anatomy
Anthropology
Astronomy
Biology
Botany
Chemistry
Geology
Mathematics
Meteorology
Minerals and Mineralogy
Philosophy
Physical Geography
Physics
Physiology
Zoölogy

SCILLY, *sil'li,* **ISLANDS.** Lying about thirty miles off Land's End are the Scilly Islands, a group of about 140 small islands belonging to Great Britain. Most of them are mere barren rocks, creating a hazard for ships. Only six of them have any importance at all, and the inhabitants, who number about 1,800, make their living by fishing and raising vegetables and flowers. These islands were known to the Romans as the "Tin Islands," but little tin has been mined.



DESTRUCTION OF A NOBLE CITY

It is said that Scipio, the Roman general, carried out the razing of Carthage much against his inclination. Every stone that stood upon another was tumbled to the ground.

SCIPIO, *sip' e o,* PUBLIUS CORNELIUS, called AFRICANUS THE ELDER (237-about 185 B.C.). A great Roman military leader, Publius Cornelius Scipio led the victorious Roman legions which added Spain and Carthage to the Roman Empire. Scipio fought in the Second Punic War in the battles of Ticinus and Cannae. He was

MAGNANIMOUS CONQUEROR

By his considerate treatment of prisoners taken at New Carthage in Spain, Scipio Africanus the Elder won support for Rome. Here he yields a Spanish princess to her betrothed.

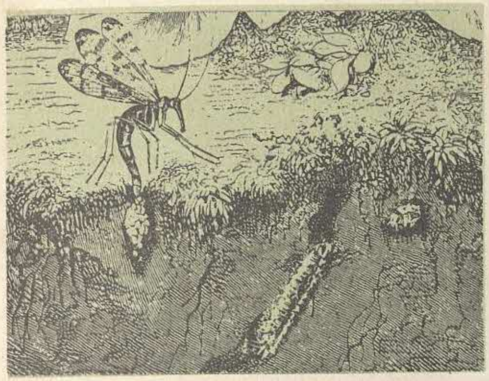
elected proconsul of Spain, where his first victory was the capture of New Carthage, the center of the Carthaginian colony in Spain. In 209 B. C. Scipio severely defeated Hasdrubal, the brother of Hannibal; and two years later, the defeats of Mago and Hasdrubal left all Spain to Roman rule.

Scipio then began his campaign against Carthage itself, and in 202 B. C. the Roman forces totally defeated the Carthaginians at the Battle of Zama. Scipio's return to Rome was a great triumph and he was given the title *Africanus*. A successful war with Antiochus, the king of Syria, in 190 B. C., led by his brother Lucius and himself, closed his military career. See CARTHAGE; ROME, HISTORY OF.

SCIPIO, PUBLIUS CORNELIUS AEMILIANUS, called SCIPIO AFRICANUS THE YOUNGER (185-129 B. C.). The adopted grandson of Scipio the Elder, Scipio Africanus the Younger was selected by the Senate to head the expedition which captured and destroyed the city of Carthage, in 146 B. C. For this achievement Scipio was accorded a triumph and the title *Africanus*. The young man had previously served with distinction in Spain, as military tribune. In later life, Scipio incurred the dislike of the people because he opposed many of the laws of the popular party, including the agrarian laws of Tiberius Gracchus.

SCISSORBILL, *siz'ur bill,* **or SKIM'-MER.** Similar to the gulls and terns, to which it is related, the scissorbill, or skimmer, gathers its food by flying close to the water, snapping up its diet of scraps and fish while in full flight. The peculiar characteristic of the scissorbill is its black-tipped orange beak, which has the long, lower mandible fitting into the upper mandible, like the blades of a pair of scissors. Scissorbills are found along the Atlantic coasts of both America and Africa. They have distinctive white breasts, black backs, and white-streaked wings.

SCORPION, *skor'pi un.* This animal is known in the United States only in the South, being rarely found north of Mary-



THE SCORPION FLY
This common insect lays its eggs in the earth.

ARACHNID JOUST
Two scorpions engaged in battle; the one at the right poises his stinging tail.

land and Kansas. Scorpions are not insects, but belong in the class with the spiders, having four pairs of legs and no feelers. The main part of the body of a scorpion is elongated, oval in shape, and somewhat flattened.

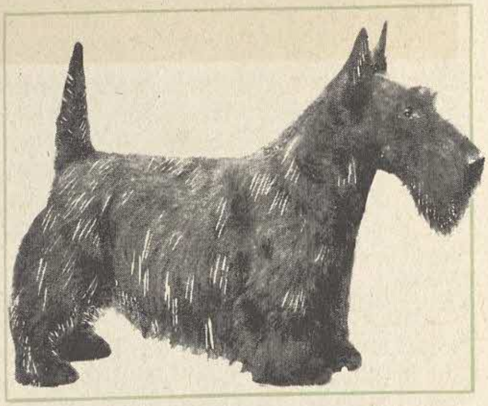
Attached to the rear part of this body is a tail-like extension consisting of several segments much narrower than the ones in the body proper. The last segment in the tail is armed with a sting which is slightly poisonous in the species found in the United States and more violently so in the larger tropical forms. The legs are borne on the front end of the body. Attached in front of the legs, near the mouth, is a pair of leglike organs armed with strong pincers similar to those on the front legs of the crawfish.

Scorpions are found under stones and other places of concealment, and in the South sometimes invade dwellings and become a nuisance. Occasionally, a specimen will be found which is literally covered with young which cling to the mother and are carried for some time by her after they are born.

SCORPION FLY. Few people except collectors notice this common insect. It has four narrow, thin wings, of equal size and with few veins, and has the tip of its abdomen curved so as to resemble the tip of the abdomen of a scorpion. The head of a scorpion fly is considerably prolonged downward into a beak, on the tip of which are chewing jaws.

Most scorpion flies are about one-half inch in length and have a wingspread of about an inch, but some are slightly larger and have legs so long as to cause them to be mistaken for crane flies.

Scorpion flies will be found from late spring on, in brush and thick vegetation, most often near wooded areas. Their larvae resemble caterpillars, but are seldom seen.



TRUSTY WATCHMAN
The little Scotch terrier has much more courage than his size would seem to warrant: he makes a thoroughly trustworthy, household watchdog.

SCOTCH TER'RIER. Sturdy, square jaws, bright eyes, and upright ears make the Scotch terrier a universal favorite among dog fanciers. The rough, coarse hair varies widely in color, and may be black, brown, sandy, or brindled. Seldom weighing over twenty pounds, the "Scotty" is an exceedingly active and intelligent house pet.

Courtesy Associated British and Irish Railways
Courtesy the French Line

WHERE THE CLANS GATHER
Skirl of pipes and the tartans worn by the Highland regiments enliven the Scottish scene.

SCOT'LAND. With its craggy mountains, forested slopes, deeply indented seacoasts, numberless lakes, and thrifty, hardy people, Scotland has for centuries been praised in poetry, song, and legend. Its warring clans, rugged beauty, and heroism are famed throughout the English-speaking world.

Geography. Scotland lies to the north of England, from which it is set apart by the Cheviot Hills and the Solway Firth. To it belong the Hebrides, Orkneys, Shetlands, and numerous other islands, all contributing to Scotland's area of 30,405 square miles. No country of its size exceeds Scotland in fine harbors, for its long coast line is sharply indented. Most important of these inlets are the Firth of Forth, Moray Firth, Firth of Tay, Firth of Clyde, Solway Firth, and the Firth of Lorne, all terminating in estuaries.

Scotland has three main geographic divisions—the Highlands, the central Lowlands, and the southern Uplands. The highest point in the Highlands is Ben Nevis, an elevation of 4,406 feet overlooking Loch Linnhe. The central Lowlands are marked with numerous low mountains, lakes, and rapid streams. These two beautiful regions have been immortalized in Scott's *Marmion, Lady of the Lake,* and *Lay of the Last Minstrel.* The southern Uplands, although mountainous, do not reach the altitude of the Highlands.

Scotland's most important rivers, including the Tweed, Forth, Tay, Dee, and Don, flow eastward into the North Sea. The Clyde, the Ayr, and the Doon flow westward. The Clyde, though small, is Scotland's most important stream, for on it moves Glasgow's ocean commerce. Among the lakes are Lomond, Katrine, Tay, Earn, Rannoch, Leven, Saint Mary's, and Doon.

Minerals. Coal and iron are by far the most important of Scotland's minerals. In Ayr County, in Southwestern Scotland, is found much of the iron ore that makes

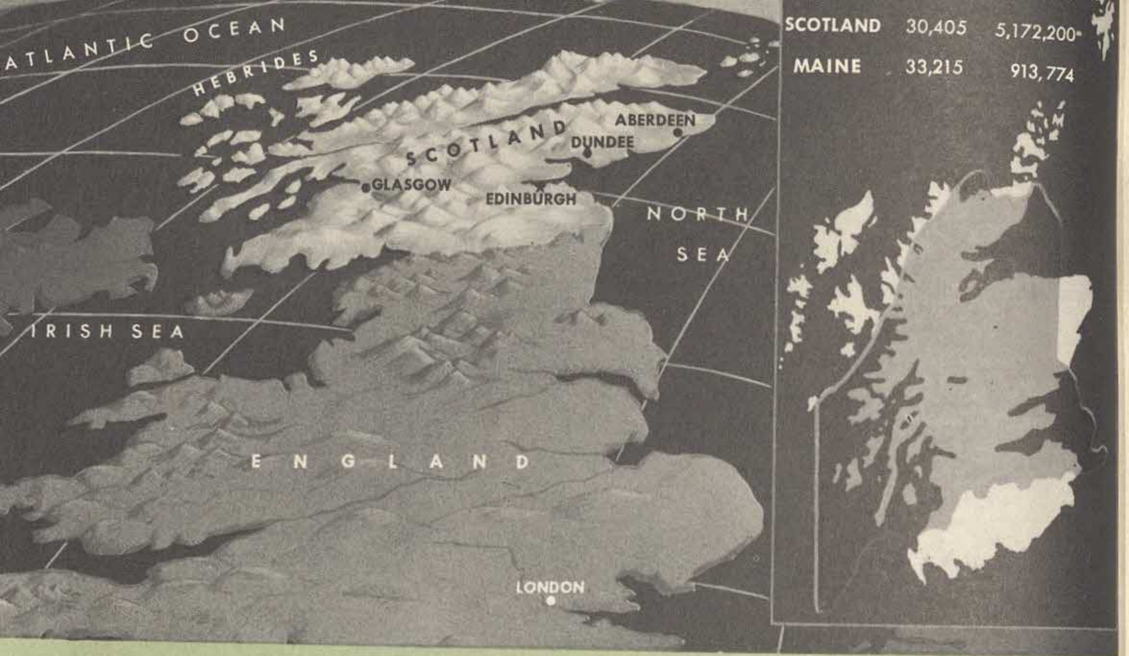
THE CHARGE OF THE HIGHLANDERS
Scottish troops of "Bonnie Prince Charlie," "Young Pretender" of the Stuart house, routed the British at Prestonpans near Edinburgh, but were later defeated by William, Duke of Cumberland, at Culloden. Right, Mary, Queen of Scots.

Glasgow the "Birmingham" of Scotland. Other minerals include shale rock (from which oil is obtained), clay, lead, slate, limestone, and granite.

Fishing. Fishing is an important industry, both along the coast and in the lakes and streams. Cod, haddock, and herring annually bring a large return to Scottish fishermen. The salmon, whale, and seal industries are almost entirely controlled by large companies.

Agriculture. Much of the land cannot be farmed, the Highland areas being devoted chiefly to grazing. Great flocks of sheep, Jersey, Angus, Galloway, and Ayrshire cattle, and Clydesdale horses add materially to Scotland's prestige as a livestock nation. Oats, barley, potatoes, turnips, and hay are the only crops of importance.

Manufactures. A large majority of the people now live in the country's industrial centers. Leading manufactures include woolen, cotton, linen, jute, and rayon goods. Glasgow's iron and steel manufacturing is one of the most important enterprises in Great Britain. Along the River



A LAND OF SCENIC BEAUTY AND BUSTLING INDUSTRY

Scotland, with its busy cities and its romantic highlands, is shown on this location map. To the right, a map of Maine has been placed over a map of Scotland to compare their sizes.

Clyde are great shipbuilding yards. Of importance also among manufactures are gloves, hosiery, whisky, sugar, and glass.

Government and Education. Local government was instituted in Scotland in 1894. The Local Government Board consists of a Secretary for Scotland as President, the Solicitor-General for Scotland, the Under-Secretary for Scotland, and three other members appointed by the Crown. Counties and parishes are governed by councils; burghs or towns by boards, provosts, and bailies. Scotland is represented in the British House of Commons by not less than seventy-one members and has sixteen peers in the House of Lords.

The head of the school system is the Scottish Educational Department. Education is free and compulsory for children between the ages of five and fourteen. Important universities are Saint Andrew's, Edinburgh, Glasgow, and Aberdeen, which receive financial help from public funds and an endowment by Andrew Carnegie. The Royal Technical College is located at Glasgow.

The People and Their Literature. The population of Scotland is over 5,000,000. Of Gaelic descent, the Scotch are noted for their industry, thrift, and integrity. The Highlanders still retain their colorful plaid kilts for special occasions and the bagpipe as their national musical instrument. Since early times they have been associated in clans. Throughout the Lowlands the people are largely urban dwellers, a big majority of whom live in the cities. The dominant religion is Presbyterian, represented by the Church of Scotland.

Until the fifteenth century the Scottish language was Gaelic or Celtic. Somewhat later, however, the language became influenced by French and Latin, brought about by the French alliance and the revival of learning. The modern tongue of Scotland resembles modern English, but is still colored by local dialects.

Thomas the Rhymer, with his thirteenth century *Sir Tristram,* is regarded as the father of Scottish literature. From that time until the sixteenth century such famous names as Douglas, Lindsay, Henryson, and Dunbar appeared in literature. Later came such writers and poets as Burns, Fergusson, Scott, Macdonald, Hogg, Barrie, Watson (Ian Maclaren), and Stevenson.

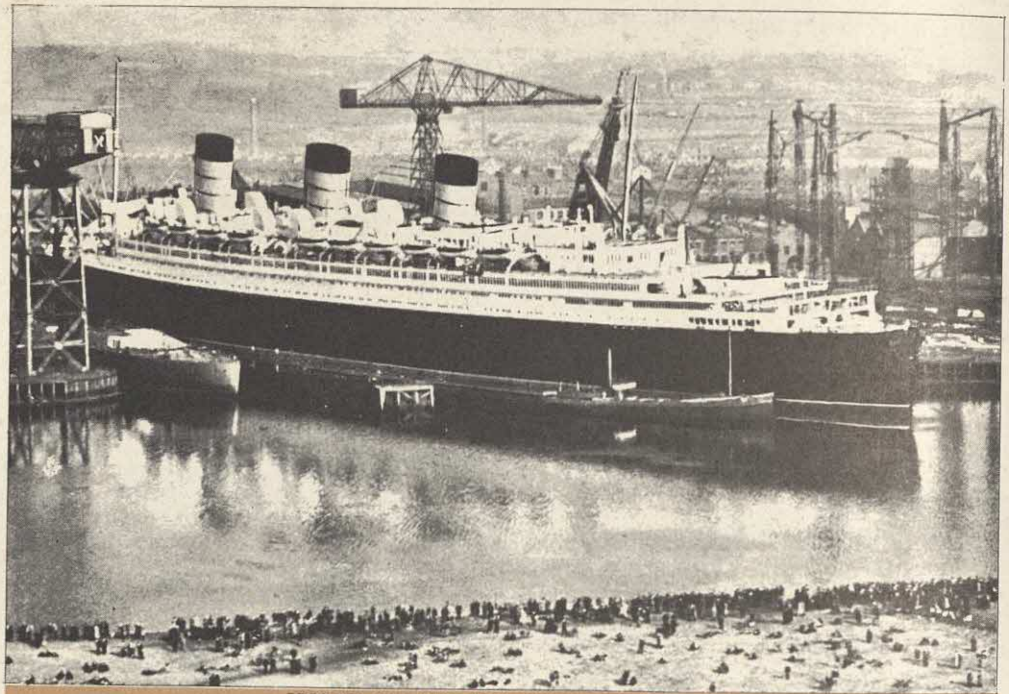
Adam Smith, Liddell, and Barclay, famous in the fields of philosophy, medicine, and law, must be added to the list of Scottish notables.

History. When the Romans invaded Scotland in the first century A. D., the country north of the Firth of Forth and the Clyde was known as Caledonia. The name Scotia (Scotland) was applied to part of the country in the tenth century and to the whole of Scotland in the thirteenth century. Originally settled by the Picts, Caledonia was never completely subjugated by the Romans. The later Roman rulers built walls in a vain attempt to stem the tide of invading Picts. At the end of the fifth or the beginning of the sixth century, the Picts were augmented by bands of Scots from Ireland. In the seventh century the region was divided among the Scots, Picts, Angles, and Saxons. It was during the sixth century that Christianity first found its way into Scotland.

Right, a bit of Scottish scenery in the land of Robert Burns. Loch Lomond, above, most famous of Scotland's lakes.

In the ninth century Kenneth MacAlpine, ruler of the Scots, also declared himself king of the Picts. Kenneth's successors greatly extended the kingdom. Duncan, the last of his descendants, was slain in 1040 by Macbeth.

A new dynasty came into power with Malcolm III in 1057. He fought vigorously against William the Conqueror but was at length obliged to pay him homage. In the latter part of the twelfth century, fighting broke out between William the Lion (1165-1214) and England's Henry II, and again Scotland was forced to submit to England. William's successors fared no better, although additional territory was added to the land by Alexander III's defeat of the king of Norway. Upon Alexander's death, the throne was claimed by Robert Bruce and John Balliol. Edward I of England decided in favor of Balliol, who ruled but a short time before being captured by the English. Resistance carried on by William Wallace proved of no avail. Under Robert Bruce, the Scotch defeated an English army



HOME OF AN ATLANTIC QUEEN

The giant *Queen Mary* at the shipyards where this craft and the *Queen Elizabeth*, a sister ship, were built. The yards extend for miles along the Clyde, build ships of every size.

under Edward II at Bannockburn in 1314. By a treaty in 1328 England recognized the independence of Scotland. But disturbances continued. Finally, in 1346, Scotland was again brought under the English yoke.

The Stuart Dynasty began in 1371 with the reign of Robert II. James I rose to power upon his release from England in 1424 and brought about an improvement, but his successor, James II, brought calamitous times to Scotland. During the reign of James III (1460-1488) the Orkney and Shetland islands became a part of the kingdom.

Religious difficulties arose during the reign of James V (1513-1542), Catholicism was overthrown, and the struggle continued between the Church of England and the Presbyterian Church. James V was succeeded by his daughter, known in history as Mary, Queen of Scots. Mary was succeeded by her son James VI, who became king of England as James I, upon the death of Queen Elizabeth in 1603. Charles I, who succeeded James, was overthrown by Cromwell and was executed in 1649. Charles II, who arrived from Holland two years later, was no sooner crowned than he, too, was forced by Cromwell to flee for his life.

Cromwell's son was unable to hold the reins of government, and in 1660 Charles II was restored to power. He immediately began the forceful establishment of the Church of England in Scotland and persecuted hundreds of objectors. During the reign of James VII (1685-1688), a revolution broke out. In 1689 William and Mary accepted the crown and restored religious freedom.

England and Scotland came under the rule of Anne in 1702, and it soon became a certainty that no lasting peace could be expected until the two countries were united as one. Consequently, in 1706, articles of union were drawn up and the following year were approved by the Scottish Parliament. From 1707 the history of Scotland is identical with the story of Great Britain.

Scotland heroically contributed her youth to the Allied cause in World Wars I and II. Such brave fighters were the Highlanders and Scotch-Canadians in their colorful kilts in the first conflict, that the Germans dubbed them "Ladies from Hell."

Consult the following titles for additional information:

Aberdeen
Bruce, Robert
Burns, Robert
Edinburgh
England
Glasgow
Hebrides
James I
Knox, John
Mary Stuart
Orkney Islands
Scott, Walter
Shetland Islands
Stevenson, Robert Louis

SCOTLAND YARD. The world's most celebrated police offices, headquarters of the London Metropolitan Police, were once located in Scotland Yard, on a small street off Whitehall. The building was so-named because it had been used in medieval times to lodge ambassadors and kings of Scotland while they were in London. In 1890 the police organization moved to its present headquarters on the Thames Embankment, and the buildings were called New Scotland Yard. The name is familiar to all readers of English crime stories.

SCOTT, Robert Falcon (1868-1912). Among the brave explorers who have perished in the Polar regions is Robert Falcon Scott. He was born at Devonport, England, and educated at Stubbington House, Fareham. He entered the English navy in 1882, in 1897 had risen to the rank of a first lieutenant, and in 1900 was made commander. On his return from an Antarctic expedition (1901-1904), of which he had command, he was promoted to the grade of captain.

In 1909 Scott organized an Antarctic expedition, with government assistance, to investigate and explore the Polar regions and to locate the South Pole. The expedition set sail in 1910. Headquarters were established on Ross Island, and various groups were sent out as special exploring parties. Scott and four companions reached the Pole on January 18, 1912, only to find that Amundsen had located it one month before. On the return trip, all the men in Scott's party perished in a great blizzard within a few miles of their station. Scott's diaries and records, which were found by a rescue party, tell a thrilling story of undaunted courage. See Amundsen, Roald; South Polar Exploration.

SCOTT, Walter, Sir (1771-1832). The Scottish border has been forever immortalized and made to live through the romantic spirit of Walter Scott, which made it possible for him to recreate in poetry and prose the dauntless bravery, stubborn will, and the appealing sentimentalism of the clansmen of Scotland who were his own ancestors.

Born in Edinburgh, he suffered a severe illness before he was two years old, which left him lame for life and too weak to enter school until he was eight. His father was a lawyer in Edinburgh, but he was sent to the home of his grandfather in the country in the hope that he would regain his strength. Here he showed an insatiable appetite for stories of the countryside and for ballads and songs; and in order that he might read the romantic tales of other languages, he learned German, French, and Italian.

For two years he attended the University of Edinburgh, and then entered his father's law office as an apprentice at the age of sixteen. He was admitted to the Scottish bar in 1792, when he was twenty-one, but the legal profession made no appeal to him. As a young man, Scott often traveled about the country, steeping himself in its history. The romantic movement in German literature was brought to his attention in 1788, through a lecture, and about the same time he heard a translation of *Lenore* by Bürger. Immediately he began translating others of the ballads, publishing them with his own poem, *The Wild Huntsman.*

The work was highly praised and started him on a literary career of prodigious activity paralleled by few other writers. *The Eve of Saint John, The Grey Brother,* the three volumes of *Minstrelsy of the Scottish Border,* and a translation of *Sir Tristram*

FROM THE WAVERLEY NOVEL

The painting shown above depicts one of the dramatic incidents in Sir Walter Scott's novel *Rob Roy*. Left, the romantic poet and novelist.

followed in rapid succession, together with a number of less important works. In 1805 he completed *The Lay of the Last Minstrel,* in 1808, the romantic *Marmion,* and in 1810, *Lady of the Lake,* which brought him to the height of his attainments as a poet. *Rokeby, The Lord of the Isles, The Bridal of Triermain,* and *The Vision of Don Roderick,* which followed, were not so well received.

Recognizing his waning popularity as a poet, Scott turned to prose in 1814, with the completion of *Waverley,* which he had begun and laid aside in 1805. It was the first of the long list of *Waverley* novels, among which are *Guy Mannering, Rob Roy, The Heart of Midlothian, Ivanhoe, Kenilworth, Quentin Durward, The Talisman,* and *The Bride of Lammermoor.* These romantic tales, animated by Scott's intimate knowledge of the history and life of his native Scotland, were published anonymously, and their authorship was not acknowledged until 1827. Nevertheless they proved a tremendous success and were very widely read. In recognition of his notable contributions to literature, Scott had been made a baronet by George IV in 1820.

In 1811 Scott purchased a hundred-acre farm on the south bank of the Tweed River, adding to it from time to time, until a large estate had been built up. On this estate, Abbotsford, Scott's dream castle, gradually took shape and was completed in 1824. Unfortunately, the full enjoyment of this fulfillment of a lifetime ambition was soon marred by financial difficulties. Scott had been associated for many years in a partnership with a printing company which later became involved with a publishing company. The latter failed in 1826, and the outcome was that Scott assumed personal responsibility to creditors for more than $600,000. From this time until shortly before his death, he wrote feverishly in an effort to meet these obligations.

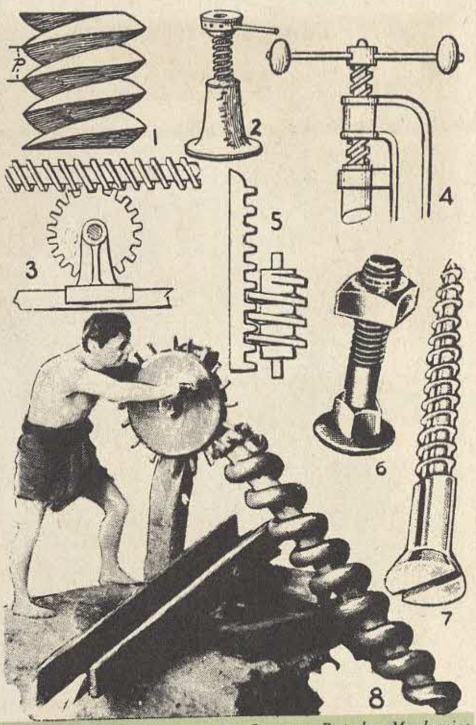
Among the works of these last years were *Tales of a Grandfather, Woodstock, The Fair Maid of Perth, Anne of Geierstein,* and the nine-volume *Life of Napoleon.* Within only two years his creditors had received $200,000. The strain was too great, however, and in 1830 Scott was attacked by paralysis. Two years later he died at Abbotsford. His remains were interred at Dryburgh Abbey, where his wife was buried in 1826. A fine biography of Scott was written by John Lockhart, his son-in-law.

SCOTT, WINFIELD (1786-1866). For his brilliant conduct of the Mexican War in 1846, General Winfield Scott ranks among America's most distinguished military figures. Born near Petersburg, Va., Scott was educated for law and was admitted to the bar. He never practiced law, however, turning instead to the army. He served with distinction in the War of 1812, winning the Battle of Chippewa and being badly wounded at the Battle of Lundy's Lane. For his outstanding service he was brevetted major general.

During the period between this war and the Mexican conflict, Scott was engaged in the Black Hawk War of 1832, and in 1841 was raised to the rank of commander of the United States Army. During the Mexican War, Scott took active command and won important victories at Cerro Gordo, Contreras, Churubusco, Molino del Rey, and Chapultepec, and finally entered Mexico City, which brought about the end of the war. In 1852 he was the Whig Presidential candidate, but was defeated by Franklin Pierce. Although a Southerner, he was loyal to the Union, but was obliged to resign his command in 1861 because of poor health. For a time he traveled in Europe, and his *Memoirs* were written and published in 1864. He died in 1866 at West Point.

SCREW. We know that lifting a heavy stone is a difficult task; but if we roll the stone up an inclined plane, the task becomes comparatively easy. The inclined plane is the basic principle of the screw.

The screw consists of a long cylinder with spiral threads cut into it. This cylinder fits into a block, or nut, which has corresponding threads. The thread which spirals around the cylinder of the screw is actually an inclined plane. If this thread were unwrapped from the cylinder and kept in the same line of inclination that it has on the cylinder, it would form an inclined line, or plane. Thus, by using a screw, a great force can be produced; at the same time, the travel of the screw is slight considering the applied force. The distance between two consecutive threads, measured parallel to the cylinder, is called the *pitch*. A jackscrew is raised by means of force applied to a handle which moves in a circle around the screw.



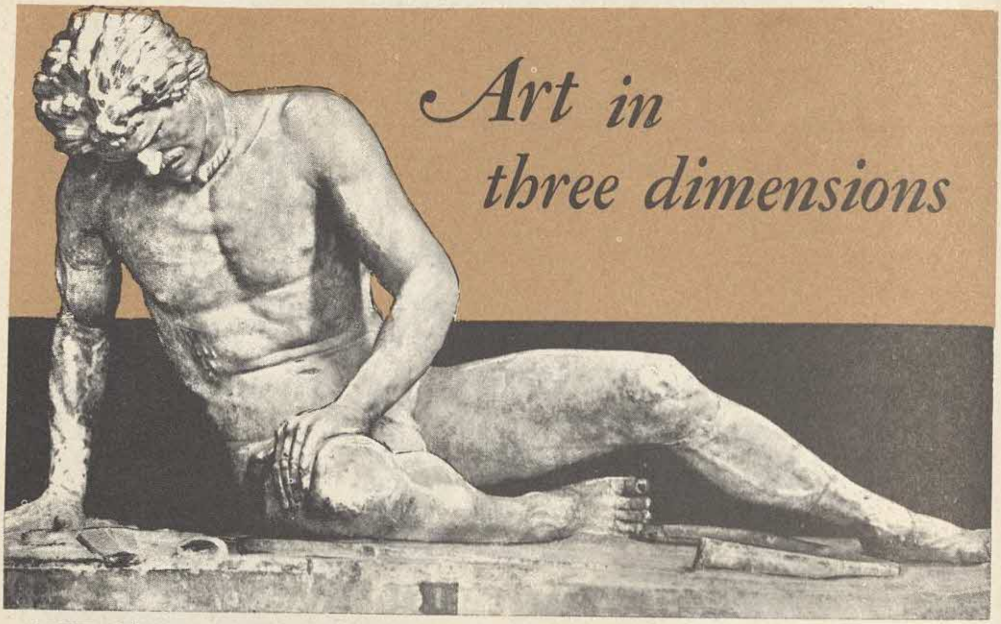
Courtesy Popular Mechanics

A DEVICE OF MANY USES

(1) The dimension *p* is the screw's *pitch*. (2) A jackscrew, used in raising buildings. (3) Wheel and screw. (4) Screw stamping press. (5) Rack and pinion gear. (6) Screw bolt. (7) Chromium-plated wood screw. (8) Archimedean screw for raising water.

The force a screw exerts depends on the pitch, the amount of friction, and the applied force and its lever arm. For instance, a jackscrew having a pitch of one-eighth inch and a four-foot handle would require a force of only about ten pounds against the handle to raise a weight of 20,000 pounds. The principal application of the screw is in wood and machine screws.

Art in three dimensions



SCULP'TURE. Man's ability to create is realized vividly in sculpture, a branch of the fine arts that has existed for thousands of years. Sculpture is an art which deals with solid materials, the carving or molding of wood, stone, clay, terra cotta, metal, ivory, bone, glass, rock crystal, wax, and even precious stones in forms of three dimensions.

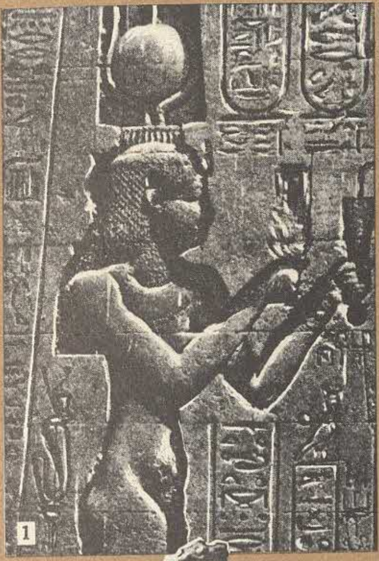
Making the Statue. There are three main classifications of sculpture. Free-standing figures or objects are in the *round;* those molded or carved so that they project from a flat surface are in *relief;* those cut or sunk into a surface are in *intaglio.*

If the sculptor is creating a statue, he usually first makes a model in clay. Nowadays, the sculptor's work usually ends with the completion of the model. Assistants then prepare a cast by first pouring plaster of Paris over the clay model, removing the clay when the mold has hardened, and then pouring in finer plaster of Paris, which, when hardened, is a copy of the original clay model. From the plaster cast, expert stonecutters, using accurate pointers, then carve the statue in marble, granite, or whatever stone has been designated for the final work.

If the statue is to be in metal, usually bronze, a core is placed inside the mold, which leaves space for the molten metal to form the outline of the statue. In the lost-wax method, the mold is lined with wax, and a core is used to fill the remaining space. After the wax is melted out, the molten metal is poured in.

History. Although examples of prehistoric sculpture have been found, Egypt lays claim to the first sculpture of recorded history. Egyptian sculptors had a style of their own, which, although it has many faults, is dignified and strong. Much of this sculpture is in relief, carved on the walls of palaces and tombs; the sculptures are colossal, and the figures are formal and stiff and show no idea of perspective. Egyptian round sculpture also is stiff and formal, as exemplified by the Sphinx, but it possesses a stability and symmetrical quality which place it among the truest forms of art.

The Grand Age of Crete was from about 1600 to 1400 B. C. In Assyria and Persia, the ancient sculptors strove for reality; and although their human figures are inferior to those of Egypt, their animal figures are superb.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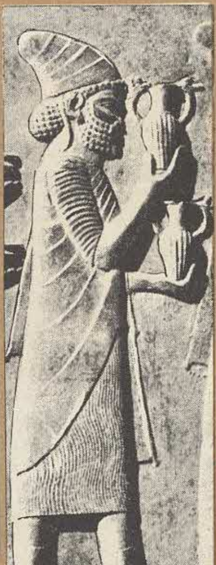
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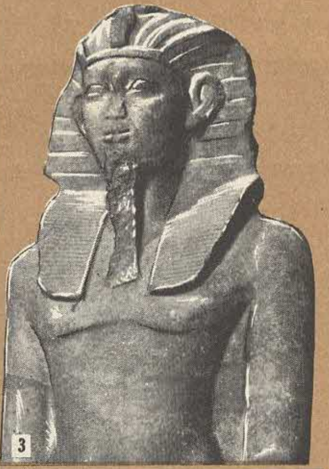
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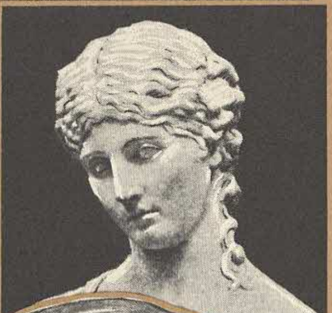
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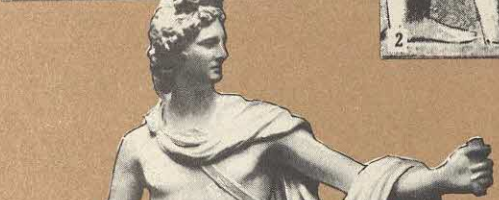
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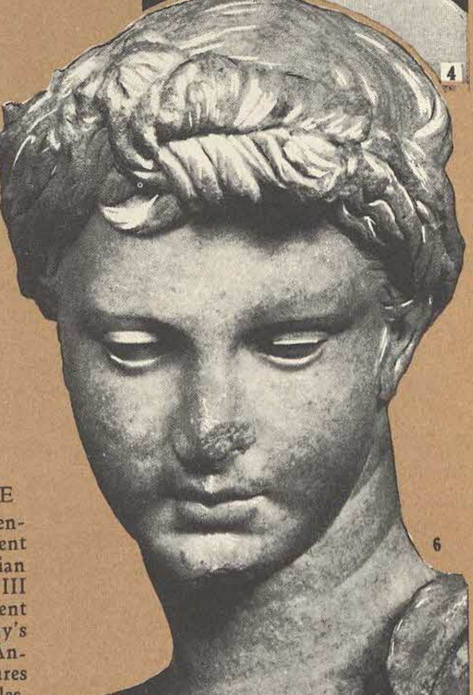
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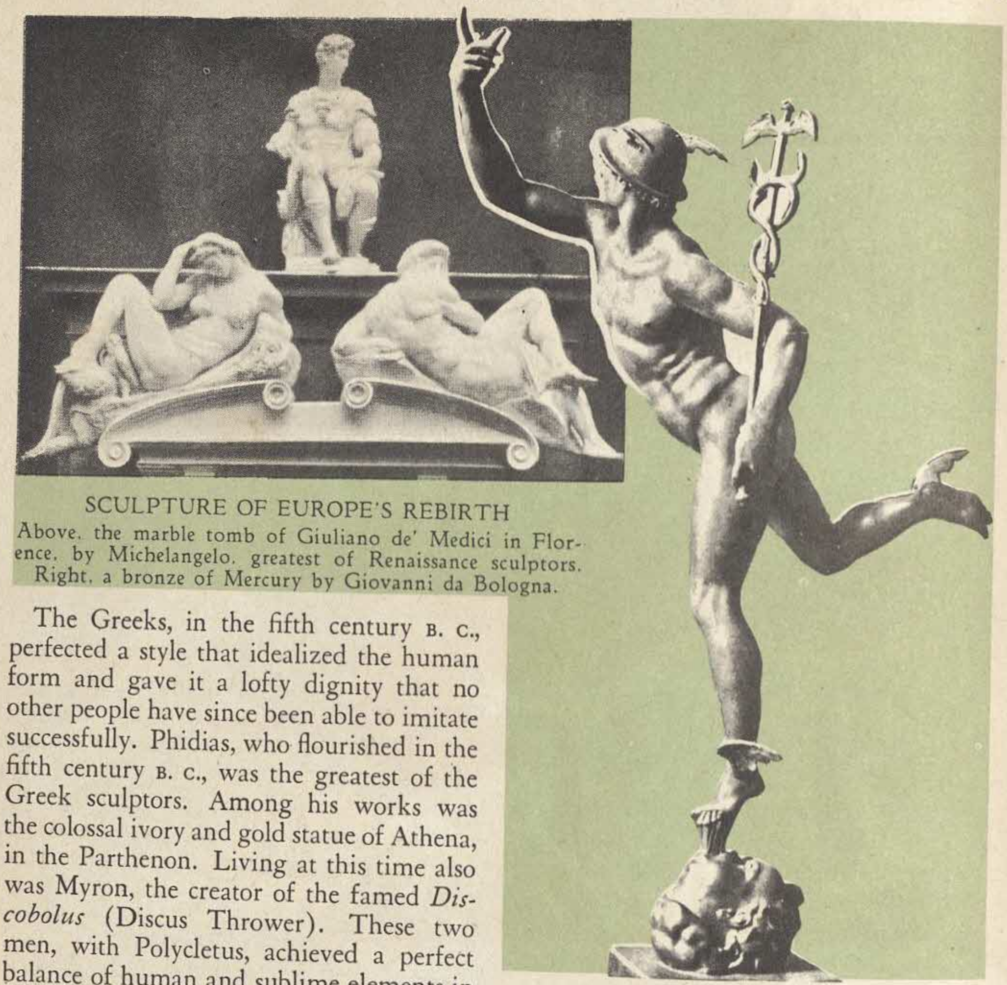
DISTINCTIVE TYPES OF SCULPTURE

(1) Egyptian intaglio sculpture of the first century B. C., representing Cleopatra. (2) Ancient Persian bas-relief. (3) Example of Egyptian round sculpture, the colossus of Sowekhotep III in the Louvre. (4) Roman realism is apparent in this beautiful likeness of Mark Antony's daughter. (5) The Apollo Belvedere. (6) Ancient Greek head, attributed to Phidias. Pictures of the Venus de Milo, the Hermes of Praxiteles, and the Winged Victory of Samothrace accompany the article GREECE.



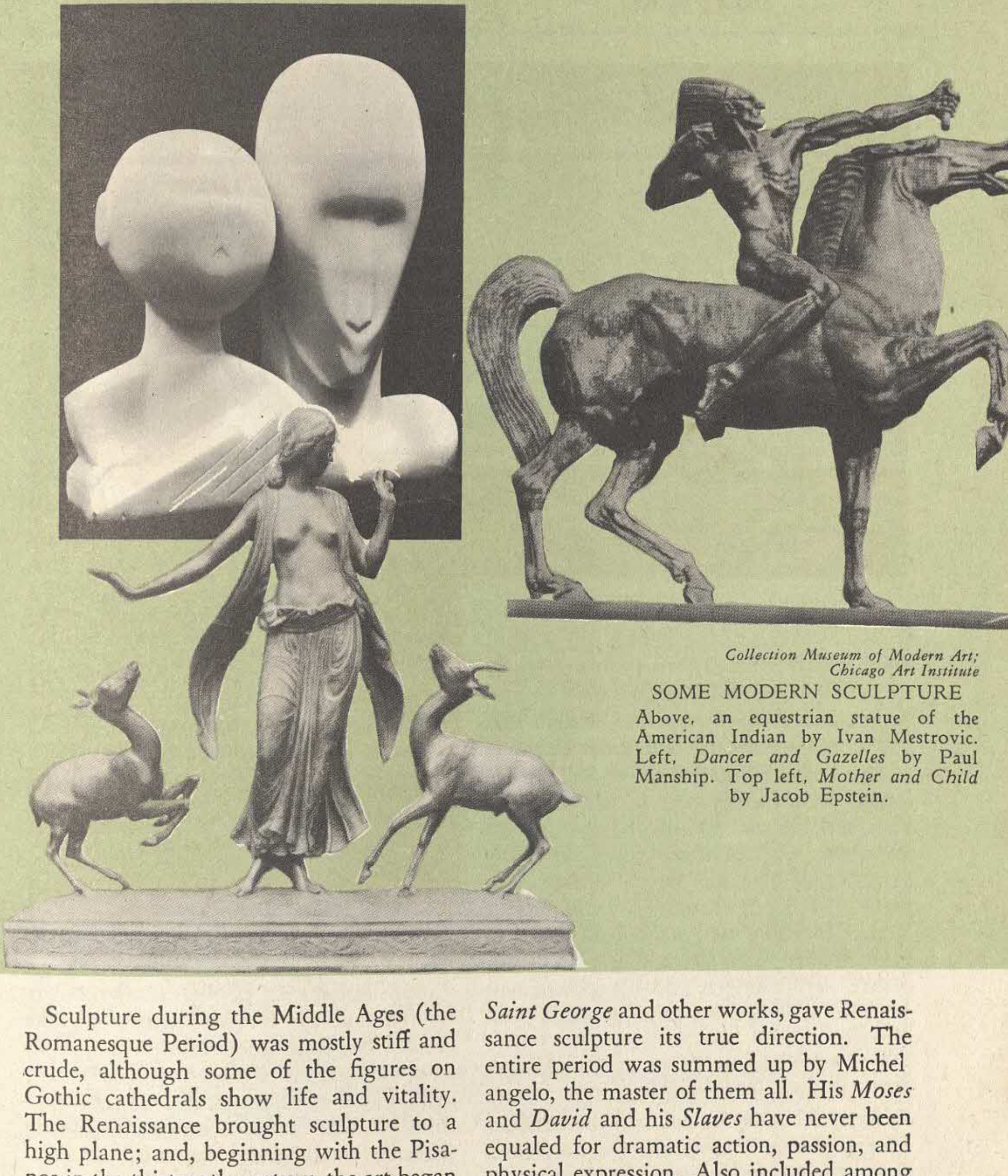
SCULPTURE OF EUROPE'S REBIRTH
Above, the marble tomb of Giuliano de' Medici in Florence, by Michelangelo, greatest of Renaissance sculptors. Right, a bronze of Mercury by Giovanni da Bologna.

The Greeks, in the fifth century B. C., perfected a style that idealized the human form and gave it a lofty dignity that no other people have since been able to imitate successfully. Phidias, who flourished in the fifth century B. C., was the greatest of the Greek sculptors. Among his works was the colossal ivory and gold statue of Athena, in the Parthenon. Living at this time also was Myron, the creator of the famed *Discobolus* (Discus Thrower). These two men, with Polycletus, achieved a perfect balance of human and sublime elements in their works.

After them came Praxiteles, Scopas, and Lysippus, whose works were more flowing and lovely. But they were also less dignified, less majestic than those of the previous century, and more given to movement. The decorations for the Mausoleum of Halicarnassus, executed about 350 B. C., are possibly by Scopas; in any case, they are in his tragic mood. This mausoleum was considered one of the Seven Wonders of the Ancient World. The original of *Hermes and the Infant Dionysus,* by Praxiteles, was found in 1877 at Olympia.

After this period, Greek sculpture began to degenerate, and in the Hellenistic and Graeco-Roman periods (323-50 B. C.) were executed such works as the *Laocoön*, the head of the *Dying Alexander*, the *Dying Gladiator, Apollo Belvedere,* and *Niobe and Her Children,* all considered inferior to earlier Greek art. *The Nike of Samothrace,* popularly known as the *Winged Victory,* was done about 306 B. C., but was not discovered until the ninteenth century. Despite its mutilated condition, it is considered one of the world's greatest works of sculpture.

Rome did little that was creative in sculpture, copying mostly from the Greeks and decorating their arches with relief figures. They did, however, inaugurate realistic portraiture; and some of the busts that have come down to us are valuable for the intricate detail of the faces.



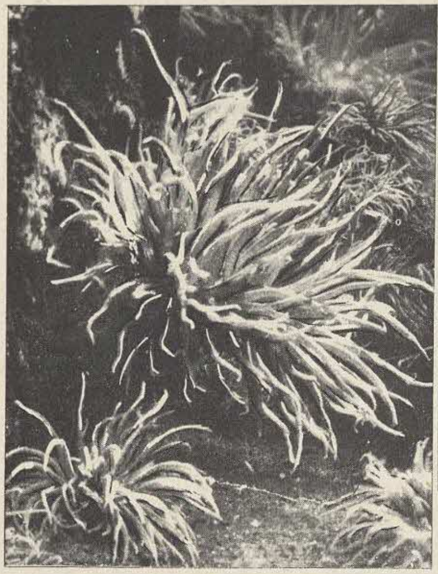
Collection Museum of Modern Art; Chicago Art Institute

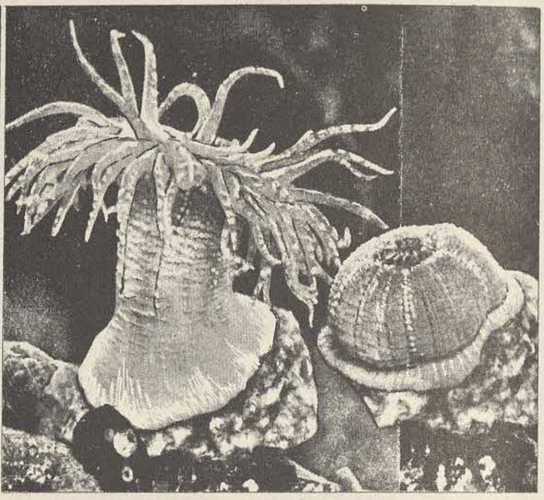
SOME MODERN SCULPTURE

Above, an equestrian statue of the American Indian by Ivan Mestrovic. Left, *Dancer and Gazelles* by Paul Manship. Top left, *Mother and Child* by Jacob Epstein.

Sculpture during the Middle Ages (the Romanesque Period) was mostly stiff and crude, although some of the figures on Gothic cathedrals show life and vitality. The Renaissance brought sculpture to a high plane; and, beginning with the Pisanos in the thirteenth century, the art began to assume much the same place in Italy as it had in Greece. Jacopo della Quercia advanced the early Renaissance art, and Luca della Robbia perfected his beautiful glazed terra cotta process. Ghiberti developed a pictorial style — a sort of painting with bronze—shown on his bronze doors for the Baptistery in Florence. Donatello, with his *Saint George* and other works, gave Renaissance sculpture its true direction. The entire period was summed up by Michel angelo, the master of them all. His *Moses* and *David* and his *Slaves* have never been equaled for dramatic action, passion, and physical expression. Also included among the Renaissance masters are Verrocchio, Cellini, and Bologna. Bernini was the most successful artist in the Baroque period that followed Michelangelo.

Sculpture has flourished in all European countries and in America. Until recently, the prevailing tendencies were toward realism and classical design; although some





OCEAN FLOOR CAMOUFLAGE

The petaled organism above looks like a marine flower in full bloom, is really an animal which stings its food with its tentacles to paralyze it, then closes over and digests it (right).

artists, like Rodin, made use of light and shade to an amazing degree, as witnessed in the famed *Thinker*. Other well-known European sculptors were Thorwaldsen of Denmark; Stoss, Kraft, and Vischer of Germany; Canova of Italy; Goujon, Pilon, Girardon, Coysevox, Puget, Pigalle, Falconet, Houdon, Rude, and Barye, of France; Stevens, Leighton, Ford, Thornycroft, Gilbert, and Frampton of England; Sluter, of the Dutch and Flemish school; Meunier of Belgium; and Troubetskoy of Russia.

The best-known American sculptors are William Rush, Horatio Greenough, Hiram Powers, Thomas Crawford, Clark Mills, Henry Kirke Brown, J. Q. A. Ward, Augustus Saint Gaudens, D. C. French, George Grey Barnard, Frederick MacMonnies, Paul Bartlett, Karl Bitter, Lorado Taft, Gutzon Borglum, and Paul Manship.

Modern sculpture has been characterized by a revolt against mere grace and beauty, and represents rather an attempt to capture the native strength and power of primitive works.

For additional information, consult the following articles:

GENERAL

Carving
Colossus
Elgin Marbles
Liberty, Statue of
Parthenon
Sphinx

SCULPTORS

Borglum, Gutzon
Cellini, Benvenuto
Donatello
French, Daniel Chester
Houdon, Jean Antoine
Michelangelo Buonarroti
Phidias
Praxiteles
Rodin, Auguste
Saint Gaudens, Augustus
Thorwaldsen, Bertel

SEA. See OCEAN.

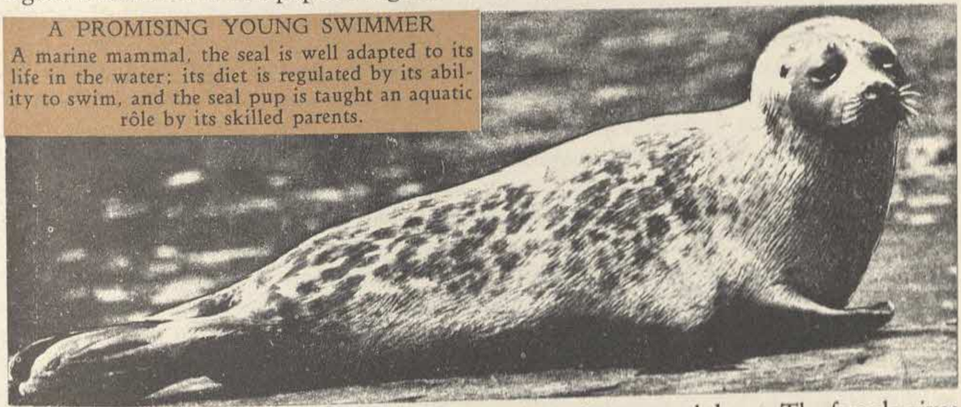
SEA ANEMONE, *a nem'o ne.* Like a vast, colorful flower garden growing on the ocean floor live the sea anemones, beautiful flower-like animals of the branch Coelenterata. Like the corals to which they are related, the sea anemones fasten themselves to stones on the sea bottom, where they appear as thick, fleshy stalks. Their "blossoms" are made up of numerous waving tentacles which grasp any small sea creature that comes within reach. The tentacles kill the prey by stinging, the mouth of the animal promptly absorbing the "catch." Under normal conditions, the tentacles will remain open, but quickly close the instant they are touched. Though these varicolored animals usually remain attached, they can move slowly about on their base of attachment. See COELENTERATA.

SEA COW. See MANATEE.

SEA CU'CUMBERS, or HOLOTHURIA, *hahl o thu'ri a.* Aside from its peculiar pickle-like shape, the most amazing feature of the sea cucumber is its ability to reproduce quickly any part of its body which may be destroyed. These peculiar creatures are related to the sea urchins, sea lilies, and starfishes (see ECHINODERMS). Through holes in the skin, small tentacles protrude. Sea cucumbers are natives of Chinese coastal waters and form an important article of food in the Orient.

SEA HORSE. See HIPPOCAMPUS.

SEA KALE. A hardy perennial vegetable of the mustard family, sea kale is grown for its young leafstalks, or shoots, which have a slight cabbage flavor. Sea kale is a favorite vegetable among the English people, but its merits are not so well known to Americans. The crisp, tender shoots, which are blanched as they grow, are ready for use in early spring, before most of the other green plants are available. Cooked and served like asparagus, they are a good substitute for that popular vegetable.



A PROMISING YOUNG SWIMMER

A marine mammal, the seal is well adapted to its life in the water; its diet is regulated by its ability to swim, and the seal pup is taught an aquatic rôle by its skilled parents.

SEAL. Gentle, harmless, and easily trained, the seal is a favorite animal of the zoölogical park or circus. Several species can be taught to play ball, blow horns, and beat drums, and their antics are delightful to watch.

There are three groups of warm-blooded mammals included in the suborder *Pinnipedia,* to which the seals belong. They are the *walrus* family, the *eared* seals, and the *earless,* or *true,* seals. The eared seals include the sea lions and the fur seals, which supply the fine pelts for fur coats. Both sea lions and fur seals have small, external ears, long necks, strong, oarlike forelimbs, and poorly developed hind limbs.

The sea lions have no fur, while the fur seals have a rich, silky undercoat of black or dark-brown fur. The *Stellar* sea lion, which lives in the North Pacific, is yellowish gray in color; the males grow to a length of nine to twelve feet, and weigh between 1,200 and 1,800 pounds. The *California* sea lion, found off Southern California and Mexico, is smaller but more intelligent.

Probably the most interesting of the entire group are the fur seals, which are found mostly in the North Pacific near the Pribilof and Commander islands. The male bulls, which mature at the age of seven years, weigh between 400 and 500 pounds, and reach a length of about six feet. Each May the bulls arrive at the rocky beaches and wait for the females, who arrive a month later. The female gives birth to a single *pup,* and then swims away for a week to feed. She returns to nurse the young seal, which usually can swim at the age of a month or six weeks.

The male seals of two, three, and four years of age, called *bachelors,* gather by themselves and stay away from the breeding grounds. These younger seals are driven up the shore by sealers, where they are sorted out, the most desirable ones being killed for their pelts. The United States government regulates the killing of seals, to prevent their extermination, and has made an agreement with Great Britain and Japan to protect them. At present about 50,000 pelts are taken yearly for the American market. During the winter the seals migrate to warmer waters, but they return to their breeding grounds each spring.

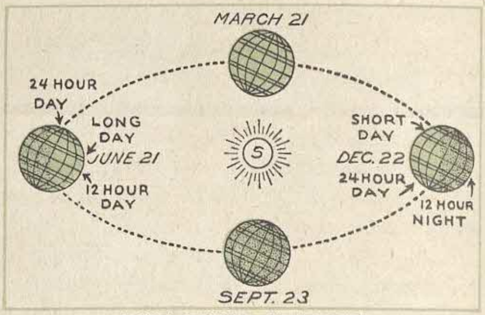
The true seals lack external ears. They have short necks, and their forelimbs are poorly developed. To this group belong the *sea elephants,* which grow to a length of eighteen to twenty-two feet, and the *hair* seals, which are important commercially for their hair, blubber, and hides. Excellent leather is made from their hides. See WALRUS.

SEA LION. See SEAL.

SEA SCOUT. See BOY SCOUTS OF AMERICA.

SEA SERPENT. In ancient days, people believed that sea serpents roamed the ocean, often boring holes in ships and devouring men. Occasionally, in modern times, persons will report seeing a monster more than sixty feet long, its head reared high above the water. The creature, of course, exists only in the imagination; the explanation usually lies in floating logs, seaweed, or schools of fish.

SEASONS, *se'z'nz.* Throughout the temperate areas of the earth there are four seasons — spring, summer, autumn, and winter. These occur because of the revolution of the earth about the sun and the tilting of the earth's axis. On March 21, the vernal equinox, spring theoretically begins throughout the Northern Hemisphere. On June 21, summer is said to begin, lasting until September 23, which ushers in the autumn season. Autumn lasts until December 22, and winter from that date to March 21. In the Southern Hemisphere the seasons are reversed, spring beginning on September 23, summer on December 22, autumn on March 21, and winter on June 21. Actually, the seasons begin slightly later than the dates mentioned.



THE FOUR SEASONS
The earth's rotation on its axis and its revolution around the sun determine our day and year. This chart shows solstices and equinoxes.

In the Polar regions, spring and autumn are so brief that the year is simply divided into summer and winter. In the tropics there is so little difference in the temperatures of the various seasons that they are identified principally by the amount of moisture falling and are known as *wet* and *dry* seasons. The coldest days in the Northern Hemisphere come in January and February because more heat is radiated from the ground than is absorbed. Conversely, the hottest days come in July and August, despite the fact that the sun's rays are most direct on June 21. See SPRING; SUMMER; WINTER.

SEA SQUIRTS, *sqwurts,* **or ASCIDIANS,** *as id'i anz.* The bottle-shaped sea squirts are marine animals which possess the power to squirt water through one of their two "necks" when removed from the water. Through the other opening, the creatures draw water into the body, and nourishment is obtained in this way. The young look much like tadpoles and are free-swimming; when they reach an adult stage, they establish a permanent home by attaching themselves to stones or shells.

SEATTLE, WASH. The immense potential wealth of the Pacific Northwest marks Seattle as a city with a promising future, just as its past development has been aided by its strategic location on Puget Sound, a mild climate, and rich natural resources of the surrounding land and waters. County seat of King County, metropolis of

PUGET SOUND METROPOLIS

An air view of part of Seattle's vast harbor, from which ships sail to the ports of the world, and the impressive business section of the enterprising city of the Northwest.

Washington, and largest city on the Pacific north of San Francisco, Seattle has a population of about 556,000. It is situated on a series of hills between Puget Sound on the west and Lake Washington on the east, and its port is about 125 miles from the entrance to the Strait of Juan de Fuca.

Lumber, airplanes, food, and metal products have all contributed to the city's industrial advancement. An outstanding enterprise is the canning and packing of fish, particularly salmon. Seattle's fine harbor swarms with ships arriving from and bound for the Orient, Alaska, South America, and the coast cities of the United States. Its piers are among the world's largest. Railroads, fine highways, ferries, bus lines, and both domestic and transpacific airlines also provide transportation.

Seattle possesses a number of imposing buildings, among which are the Smith Tower, forty-two stories high; the huge civic auditorium, which has a floor area of nearly 63,000 square feet; and the public library, possessing 2,000,000 volumes. Climatic conditions in and near Seattle are world-famed. The summers are cool and the winters mild. Snow is a rarity, and outdoor sports can be played the year around. The near-by snow-clad peaks of the Cascade and Olympic mountains offer ideal facilities for winter sports. Seattle is accessible to Mount Rainier National Park and many other scenic spots.

More than 250 churches are located in Seattle, and the University of Washington, largest educational institution in the Northwest, is situated in the city. The city owns and operates the municipal system for the production of electric light and power.

Seattle was first settled by white men in 1852, and it was named for a friendly Indian chief. In 1853 it was laid out as a town, and was incorporated in 1869. Seattle grew slowly until 1884, when the first transcontinental railroad reached the city. Acquisition of the Philippines and the discovery of gold in the Yukon stimulated trade and greatly increased the population. Shipbuilding flourished, and at one time Seattle led all other North American cities in this industry. It built many ships during World War II, when important military and naval installations were also centered there.

SEA UR'CHIN, or ECHINUS, *e ki'nus.* This odd sea animal received its name urchin because its spines resemble those of the hedgehog, and the hedgehog is also called urchin. Sea urchins are scavengers and live near rocks or coral reefs. The spines on the globular body have sucking discs, and those on the underside serve as legs. Sea urchins are found in shallow water throughout the world, the largest being taken from the tropics. In some places, they are used as food. They belong to the same class as the sea cucumber (see ECHINODERMS).

SEA'WEED. See ALGAE; KELP.

SECESSION, *se sesh'un.* Until 1865, the question of the right of a state to secede from the Union was an undecided one, although the subject came up many times before the Civil War. Today, however, no one raises the question of secession. Americans decided, by a bitter struggle, that no state has the right to withdraw from the United States.

In 1798 the question of secession was raised by the Republican, or Jeffersonian, party, now called the Democratic party. The threat of secession was intimated in the Kentucky Resolutions, framed by Thomas Jefferson (see KENTUCKY AND VIRGINIA RESOLUTIONS). On the other hand, when Jefferson was President the New England states talked secession because they feared the power of new states to be created in the Louisiana Purchase. The War of 1812 brought on additional talk of secession in New England. South Carolina brought secession to a paramount issue in 1828 because of the tariff law, the argument used by James C. Calhoun being that every state was sovereign, and that the Federal government was merely a creation of the states.

In none of these incidents, however, did actual secession take place. Secession first became a reality in 1860, when, led by South Carolina, eleven states in the South withdrew. The war definitely ended the question of secession. See CIVIL WAR IN AMERICA; CONFEDERATE STATES OF AMERICA.

SECRETARY OF STATE. See STATE, DEPARTMENT OF.

SECRETION, *se kre'shun.* The glands and some membranes of the body elaborate specialized products from the blood for use in the body. These products are secretions. Certain products of a harmful or useless nature, which are discharged from the body, are called *excretions.* Urine is an example. True secretions, unlike excretions, are not merely filtered out of the blood, but are made in the secreting organs. Examples of true secretions are gastric juice, bile, saliva, and milk.

Ductless glands, like the thyroid, suprarenal, and pituitary, are true secreting glands, but they pour their secretions directly into the blood. See GLANDS.

SECRET SERVICE. In the United States government, the Secret Service is a division of the Treasury Department. It was organized in 1860 for the purpose of detecting and capturing counterfeiters; and this work is still one of the major functions of the division. Another important duty of the Secret Service is to guard and protect the President of the United States, the members of his family, and the President-elect.

Secret Service operatives also investigate the forgery of government checks and theft of government property, and violations of the Federal Farm Loan Act, the Federal Farm Credit Act, the Gold Reserve Act, and other crimes involving Federal laws which pertain to the Treasury Department. The Federal Bureau of Investigation is under the Department of Justice, and is not a division of the Secret Service. See FINGERPRINT IDENTIFICATION.

SECURITIES AND EXCHANGE COMMISSION. Proposed by President Franklin D. Roosevelt, the Securities and Exchange Commission was established by Congress in 1934. Its activities include the supervision of the registration of security issues and suppression of fraudulent practices in the sale of securities; the supervision and regulation of transactions and trading in securities in the stock exchange and in "over-the-counter" markets, and the regulation of public-utility holding companies.

The commission is composed of five men, each appointed by the President for a term of five years, with the terms arranged so that there will be a vacancy at the end of each year.

SEDAN, *se dahn'*, BATTLE OF. The defeat of France in the Franco-German War was sealed by the victory of the Germans in the Battle of Sedan, September 1, 1870. Previous to this date, Marshal MacMahon, in command of the French troops, had been pushed back by the superior German army almost to the Belgian border. Instead of retreating farther, MacMahon decided to occupy the heights of Sedan, a small village.

The Germans attacked early in the morning, and by late afternoon had driven the French out of their positions into the fortress in the village. When the bombardment of the fortress began, Napoleon III, who was present, ordered a flag of truce to be flown. Napoleon and 86,000 men and officers were taken prisoners, and the road to Paris was opened to the German army. See FRANCE; FRANCO-GERMAN WAR.

SEDIMENTARY ROCKS. All rocks that have been deposited by water or air are sedimentaries, whether solid or unconsolidated. The material of which sedimentary rocks are made is derived from any kind of rock that may exist on the land. The size of the particles depends on the force of the stream that carried them. The wind will move fairly coarse sand during heavy storms, but, usually, fine sand or silt particles are the largest that are carried by the air. The wind-carried sand makes dunes such as are seen in any sandy country like the eastern shore of Lake Michigan (see DUNE).

The fine dust carried by the wind makes deposits of loess such as are seen in the bluffs along the Missouri River at Omaha, and along the Mississippi River from Wisconsin to its mouth. Much of the top soil in the Mississippi Valley contains a large amount of wind-blown dust or loess.

The water-carried material may be of almost any size up to rocks weighing tons. Mountain streams tumble great blocks along their steep courses until they reach the plains at the foot of the mountains. In the less steep parts of their courses, the streams can move only cobblestones, gravel, and sand; and when they reach a lake or the sea, so that the current is slowed down, only the fine mud and dissolved matter are carried any distance; even the fine mud is soon deposited.

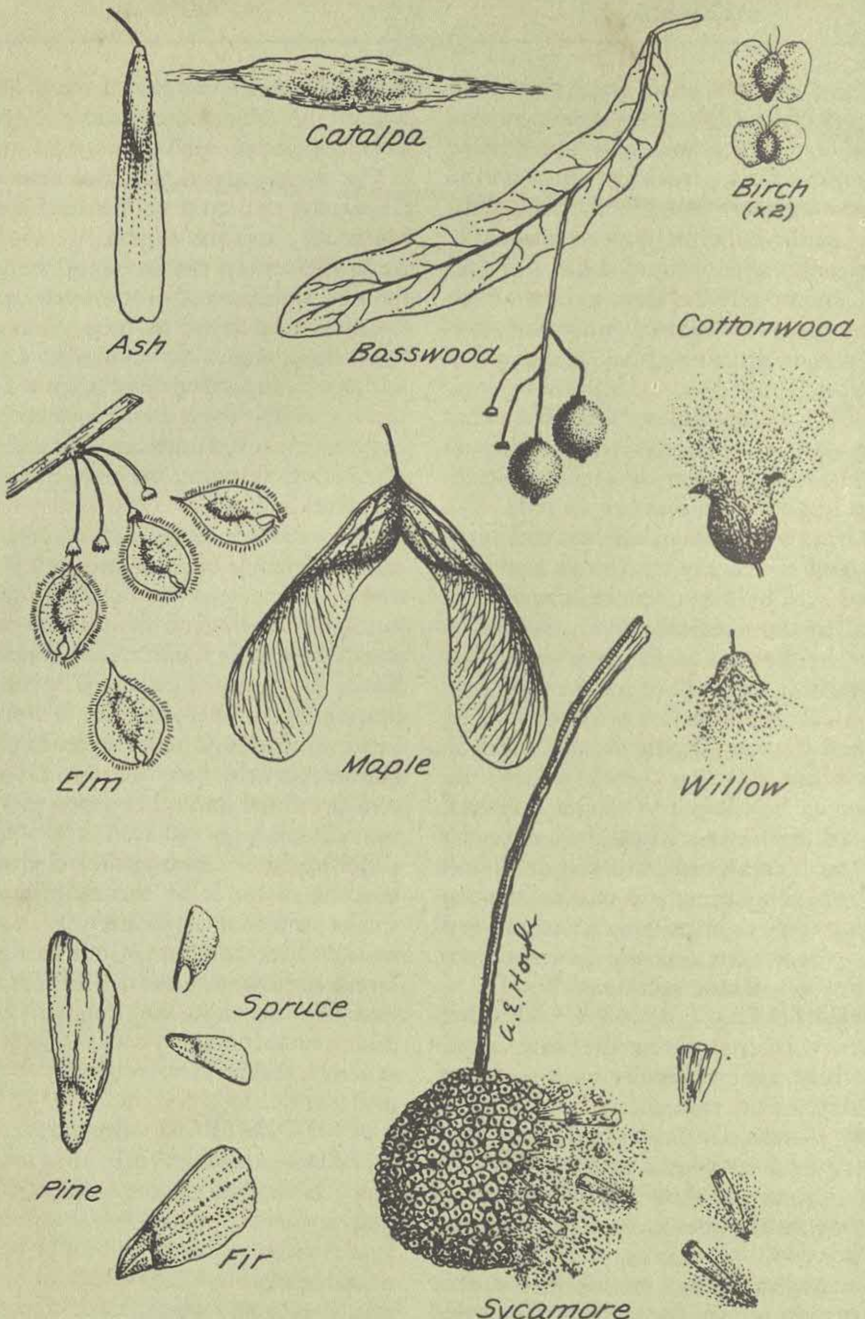
The water effectively sorts the material it carries. Sorting has resulted in separating the sediments into three chief groups: the sands, the shales, and the limestones. The sands are mostly quartz (see SANDSTONE). Shales are the rocks produced by the solidification of the mud deposits. They consist chiefly of clay and other exceedingly fine-grained particles (see SHALE). Limestones consist of lime and other substances which were carried in solution and deposited either by the water animals and plants that lived on them, or by chemical means.

The material deposited by water is worked over and spread out in wide, flat layers, sometimes hundreds of miles in extent. The most striking feature of an exposure of sedimentary rocks is these layers, or strata, and so they are often called *stratified* rocks. See GEOLOGY.

SEED DISPERSAL. See SEEDS.

SEEDS. Although there are a few plants (such as the potato, onion, strawberry, currant, and sweet potato) which can be propagated without seeds, it would be an almost hopeless task to attempt to raise such plants as corn, wheat, oats, tomatoes, or cabbage from slips, cuttings, grafts, and layerings.

What a Seed Is. A seed is a tiny plant, resting in its development, protected by a hard covering, and usually supplied with nourishment for future growth. Plants have not always been propagated by seeds; indeed, the lower forms of plant life are not



U.S. Forest Service

WINDBLOWN TREE SEEDS TAKE MANY STRANGE FORMS

The forest seeds pictured above travel varying distances before landing to take root. The single-wing catalpa, ash, basswood, spruce, pine, and fir seeds drift to earth with a whirling motion. Maple seeds are carried on both single and double wings. Birch and elm seeds glide downward on rounded wing structures. The tiny seeds of the cottonwood, sycamore, and willow have downy parachute-like attachments, and are often blown many miles by the wind.

now. Some of these lower forms reproduce by spores; some have two kinds of spores, one large and one small, and a new plant springs into being when a growth from the microspore (small spore) attaches itself to the egg of the megaspore (large spore).

Seed plants reproduce by a tiny grain of pollen (microspore) growing into an almost invisible plant that produces sperm cells. When these unite with the egg of the plant grown from the megaspore, the large, green plant that we know starts developing. Before the development has progressed very far, the new plant becomes completely enclosed in a sturdy case which protects it until it can find a favorable time and place for further development. Until its growth is resumed, the little plant lies dormant as a seed (see GERMINATION).

Seed Testing. The importance of seed testing has long been evident. The first seed-testing laboratory was established at Tharandt, Saxony, by Professor Nobbe in 1869. From this start, such laboratories sprang up all over the civilized world. Most farmers lack such facilities and so buy tested seed. However, many farmers test corn by placing a few grains from selected ears in a dish between two sheets of damp blotting paper, covered with a moist cloth and kept at a temperature equal to that of the soil at planting time. By the sprouting which takes place in from eight to ten days, the farmer determines the percentage of good seed in the ears selected.

Seed Dispersal. Only a small part of the world's seeds are planted by man. To assure a distribution of the others, Nature has devised ingenious schemes. Some, like the seeds of the cottonwoods, poplars, dandelions, and milkweed, are constructed like tiny parachutes and are wafted away by the wind. Others, like the maple, olive, and elm, are borne on wings to near-by points. A few are covered with a sticky substance and are carried to a new region by birds and animals.

Coconuts and some of the rushes drop their seeds into water, which floats them to a new location. Tumbleweeds, pigweeds, and tickle grass break loose from their roots in the fall and tumble across the ground, scattering their seeds as they go. Nature has fitted the cockleburs, sandburs, and many other varieties of seeds with spines which cling to animals and are carried for great distances. Ferns have no seeds, but are reproduced by spores which form on the underside of the leaves and take root when the leaves fall.

In spite of all these devices, only a small portion of the seeds ever produce plants, for the weaker ones are crowded out by the stronger. Otherwise, we should be living in dense jungles like those now found in much of the tropics.

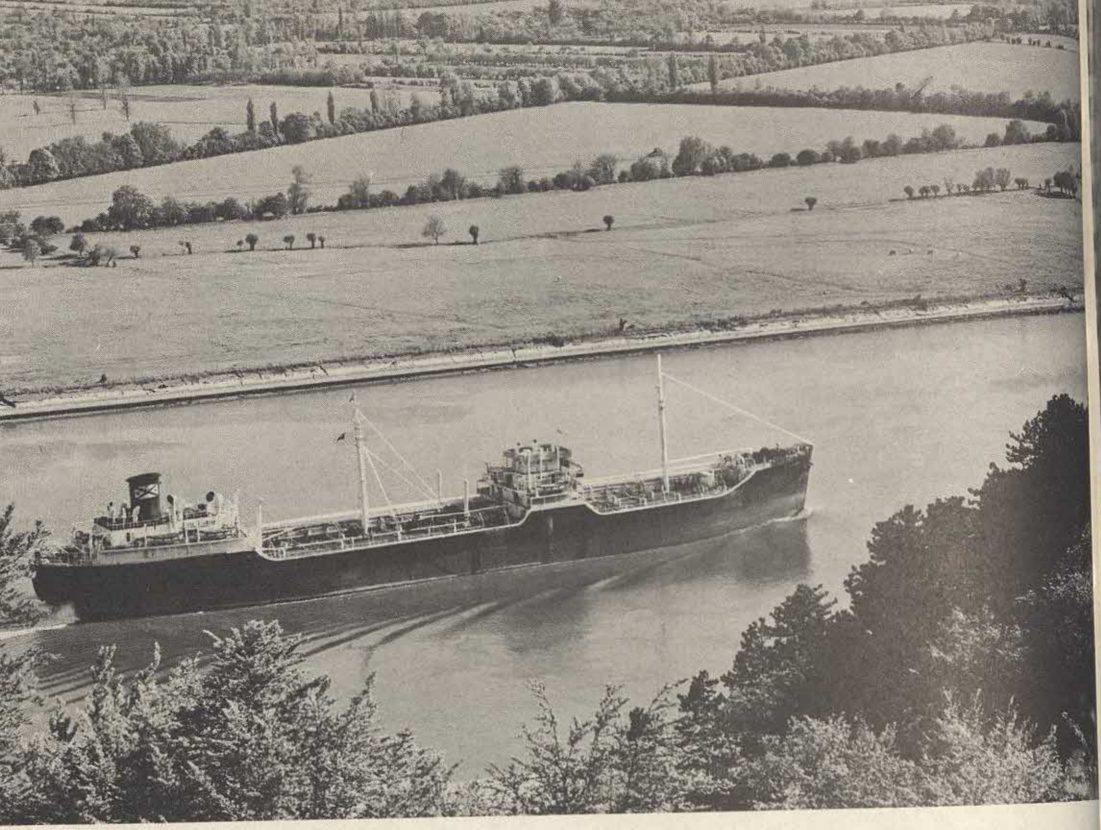
SEIGNIORAGE, *seen' yur ayj.* When a person brings his own metal to a mint to be coined into money, he is usually charged a small sum, called seigniorage. This charge may be for expenses involved in making the coins, or represent a profit to the government. Under the feudal system, seigniorage was the royalty paid an overlord upon the mining output of certain minerals.

SEINE, *sayn.* Through the city of Paris winds the river Seine, the most important waterway of France. It rises in the department of Cote-d'Or and winds in a general northwest direction for a distance of 472 miles, flowing into the English Channel.

PARISIAN DIVIDING LINE

The famous right and left banks of Paris are determined by the course of the Seine River.

Standard Oil Co. (N.J.)



Standard Oil Company (N.J.)

THE RIVER OF GENTLE WATERS

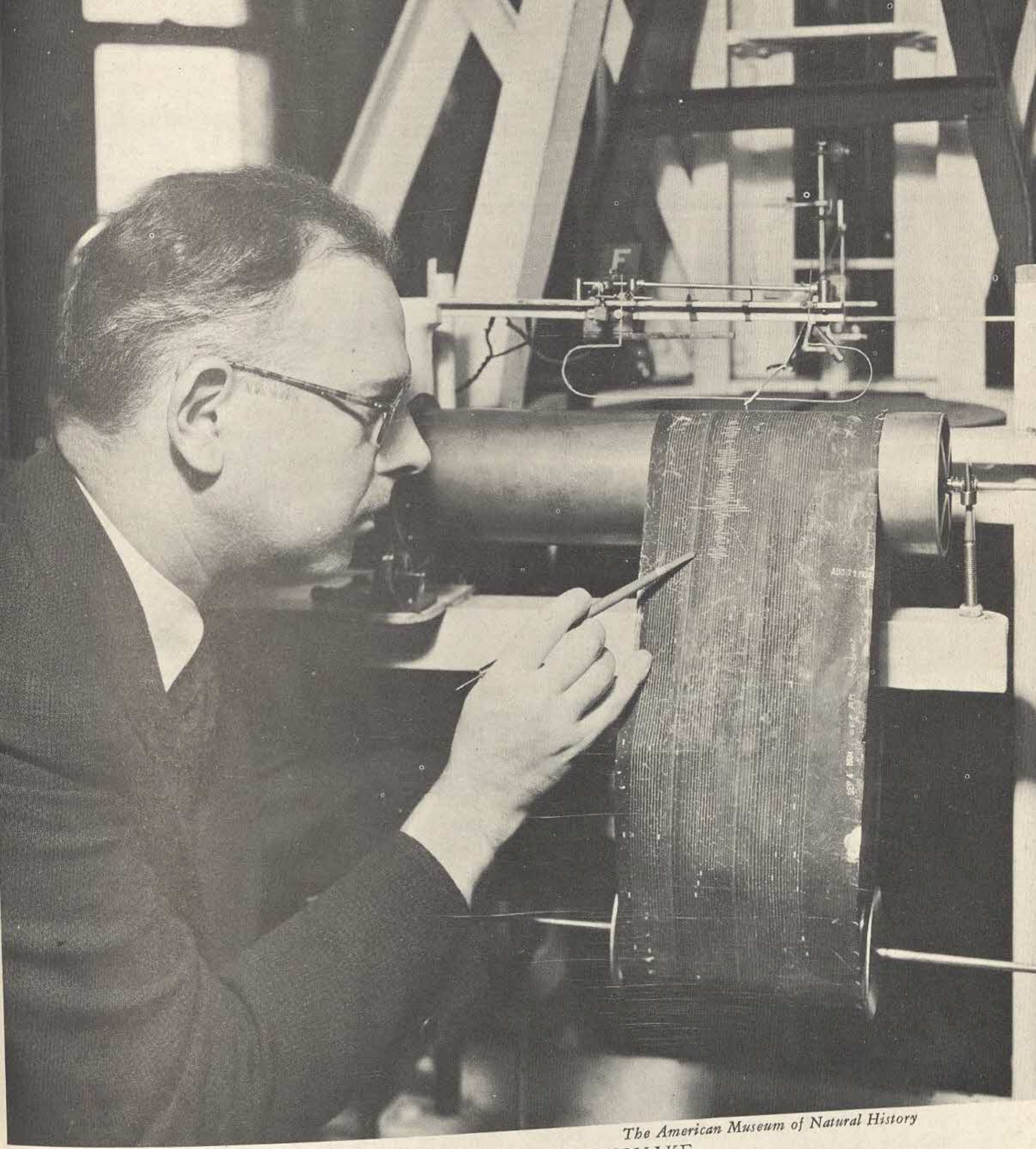
Though the Seine is a commercial waterway, bustling with boats carrying passengers and freight, it is a very peaceful river. Its waters flow gently and smoothly and its banks in the country are lined with small farms. For much of its length it lies only about 300 feet above sea level, and on only a few occasions has it been known to flood its banks and cause damage.

The Seine, which is navigable for three-fourths of its total length, is joined to the Rhine, the Rhone, the Loire, and the Meuse rivers by a system of canals. Small boats move up and down its length carrying passengers and cargo. The famed right and left banks of the city of Paris are determined by the banks of this scenic river.

Because of its location and the large city which occupies both banks, the Seine has figured greatly in the history and romance of France. In midstream at Paris is the Isle de la Cité, the site of the original city of Paris, the Cathedral of Notre Dame, Sainte-Chappelle, and other famous Parisian landmarks. See PARIS.

SEINING, *sayn' ing.* Of all the various methods used by commercial fisheries to snare fish, seining is probably the most important. In general, seining makes use of a long net dragged by a fishing boat into a circle around a school of fish. Then, either by hand or with a power winch, the net is slowly drawn closed or dragged onto land, or towed close to the beach to entrap the fish in a small area.

One of the most complicated types of seine is the *purse seine*. It has a series of rings around its bottom edge and a draw line running through the rings. After the net has been placed in a circle around a school of fish, the line in the bottom is drawn closed, much like the drawstring of a purse, and the fish are trapped in a sack-like pouch. Salmon, menhaden, mackerel, and sardines are often fished in this manner. Each fishing operation, however, uses a special technique in the handling and operation of the seines.



The American Museum of Natural History

A PICTURE OF AN EARTHQUAKE

In the Mainka seismograph, above, the frequency and intensity of earth tremors are recorded by a fine point moving across smoked paper on a revolving drum. This type of seismograph is being replaced by one using a light beam passing across a photographic film.

SEISMOGRAPH, *size' mo graf.* From the Greek words meaning *earthquake record* the seismograph gets its name. It is a very delicate instrument used to measure and record the force, direction, time, duration, and location of movements of the earth's crust caused by earthquakes. It is also used in prospecting and the detection of distant nuclear explosions. The instrument consists of a finely balanced pendulum so hung that it starts oscillating at the slightest tremor or movement in the base, which is in direct contact with the earth's surface.

In some instruments a sensitive recording device is connected at one end with a weight attached to the pendulum, and at the other end it bears a sharp point or stylus which traces the results of earth movements on a smoked surface or on a roll of paper carried on a revolving drum; in other instruments the recording is effected through an induced electric current and a photographic process using a moving film. Any one of three types of pendulums may be used: vertical, inverted, or horizontal. See EARTHQUAKE.

SELE'NIUM. In 1817 J. J. Berzelius discovered a new element in the wastes of a Swedish sulphuric-acid manufacturing plant. It is a rare element similar to sulphur and tellurium in its chemical properties, and occurs in nature usually in combination with other minerals, particularly with sulphur, copper, lead, iron, and silver. Metallic selenium, one of several forms of the mineral, conducts electricity, and its conductivity becomes greater as light is increased.

This property made possible the invention of the selenium cell by means of which photographs can be transmitted by telephone, telegraph, or wireless, blind persons can read type, and beacons and buoys can be lighted automatically. Combined with hydrogen, the element forms the evil-smelling *seleniuretted hydrogen,* sometimes added to odorless but deadly gases so their presence may be detected. Red selenium is used in the manufacture of glass and red enamels. The symbol of the element is *Se.*

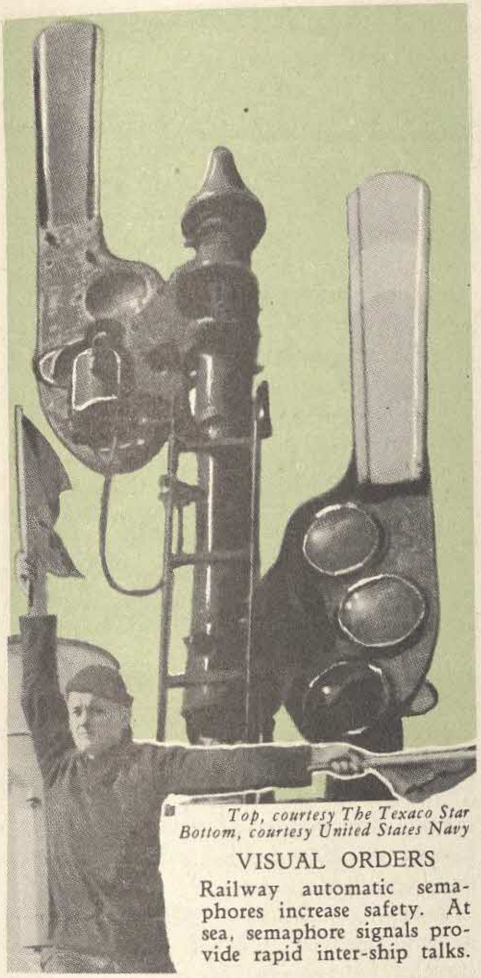
SELJUKS, *sel jooks'.* A powerful Turkish dynasty which derived its name from Seljuk, a chieftain of the Ghuz Turks, ruled over Western Asia from the eleventh to the thirteenth centuries. The Ghuz Turks conquered Persia in the year 1030, and this country formed the nucleus of the later Seljuk Empire which was to consist of Persia, Armenia, Turkestan, Syria, and Asia Minor. The First and Second crusades were launched largely against the Seljuks because of their cruelty to Christians. Omar Khayyam, the great Persian poet, flourished during the Seljuk period which, in general, was a second Golden Age for Persia.

SEL'KIRK, ALEXANDER (1676-1723). Daniel Defoe's fanciful story of *Robinson Crusoe* is said to have been inspired by the experiences of Alexander Selkirk, Scottish adventurer and sailor who lived four years and four months on an uninhabited South Sea island. Selkirk, a member of several pirate expeditions in the South Pacific, quarreled with the captain of a ship on which he was sailing, and finally asked to be put ashore on one of the small Juan Fernandez Islands. Here he remained until rescued by the captain of a privateer. After his return to Scotland, in 1712, his adventures became known, and Defoe later adapted them for his famous story, which appeared in 1719. Selkirk later became a lieutenant in the navy. See JUAN FERNANDEZ ISLANDS.

SEMAPHORE, *sem'a for.* Before the invention of the telegraph, telephone, and electrically operated signal lights, the semaphore was a widely used and very necessary means of communication. It is still used for signaling directions on railroads and in the army and navy.

The most familiar type of semaphore is that used for railroad signals. It consists of an upright standard eighteen to twenty feet in height, to which is attached an arm. The arm is usually painted red or white and can be raised or lowered from a near-by telegraph office. In one end of the arm are frames of colored glass which indicate the signals at night. When the signal arm is dropped, it means that the track is clear and trains may proceed; when the arm is set at a 45-degree angle, it means caution—proceed slowly; and when the arm is set horizontally, it means stop. The lights which correspond to these signals are red for stop; white for clear track; and green for caution—proceed slowly.

A semaphore used by the navy carries two arms. Letters of the alphabet are rep-



Top, courtesy The Texaco Star
Bottom, courtesy United States Navy

VISUAL ORDERS

Railway automatic semaphores increase safety. At sea, semaphore signals provide rapid inter-ship talks.

resented by the positions of these arms, and messages are spelled out by changing the positions. In the navy sailors use the same code, employing their own arms for a semaphore, or wigwagging with flags.

SEMINOLE, *sem'i nohl.* Florida's Everglades region, a swampy, lonely wasteland, is inhabited today by the Seminoles, descendants of what was once a powerful Indian tribe. Originally belonging to the Creek tribes, they lived in towns on the Chattahoochee River. In the eighteenth century they separated from that group and settled in Florida, taking the name Seminole, which means *seceder*.

In 1817, when General Andrew Jackson invaded Florida, the Seminoles resisted stoutly, and two years later, when Florida became a possession of the United States, a treaty was signed for their removal to the land west of the Mississippi. A number left for their new home, but, under Osceola, many stayed and resisted in a war that lasted from 1835 to 1842. Most of them were then taken forcibly to Oklahoma. Those remaining in Florida have lived under almost autonomous government.

SEM'ITES. Civilization owes much to the Semites, who, on the southern and eastern shores of the Mediterranean, developed cultures that have profoundly influenced the modern world. The Semites are people who speak one of the languages which scholars classify as Semitic. Among the Semites of the ancient world were the Babylonians, Assyrians, Phoenicians and Carthaginians, the Canaanites, Moabites, and other tribes of Palestine and Syria, and the Arabs. From these peoples came three world religions — Judaism, Christianity, and Mohammedanism. The Old Testament records the history of a number of the Semite kingdoms of those times.

SEMITIC LANGUAGES. Scholars divide the Semitic languages into various groups. Babylonian and Assyrian, for example, are placed in the eastern group. The Canaanite tongues included Moabite, Phoenician, Punic (the form of Phoenician which was spoken by the Carthaginians), and Hebrew. Aramaic was the language of Jesus. It had several ancient forms and is still spoken in some parts of the region which was once Palestine. Today, Arabic is by far the most widely spoken of all the Semitic languages. It is commonly used in Saudi Arabia, Iraq, Syria, Egypt, and other parts of the Arab world. Modern Hebrew is also a Semitic language, as is Amharic, a language of Ethiopia. Geographically, then, Semitic languages spread from Western Asia to the Middle East and on to Africa.

The greatest literary achievements in the Semitic languages are the books of the Old Testament and the Mohammedan Koran.

For additional information, consult the following articles:

- Alphabet
- Christianity
- Cuneiform Inscriptions
- Hebrew Language and Literature
- Jews
- Mohammedanism

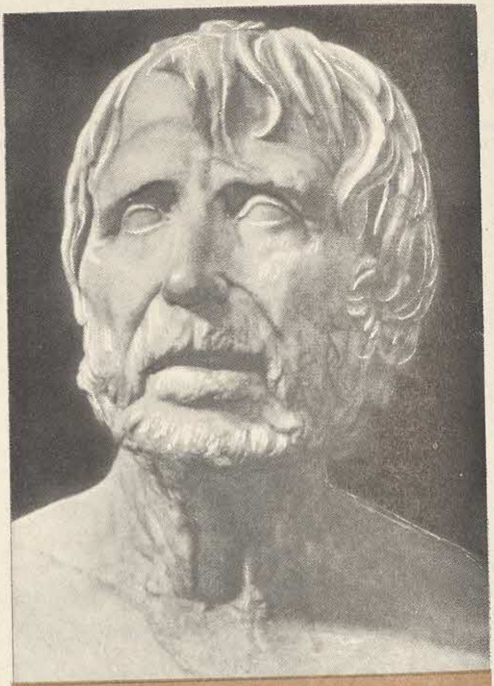
SEN'ATE. Established, according to tradition, by Romulus, the founder of Rome, the Senate was the supreme legislative body of ancient Rome. Under the republic, its members were chosen by the consuls, the consular tribunes, and the censors, but since they were required to select Senators from those who had been magistrates, the body was fairly representative of the people. In ordinary times, the power of the Senate was supreme, but in crises the group could vote absolute powers to the consuls. The number of the Senators varied from 100 to 1,000, since each emperor diminished or increased the body to suit his own plans.

In modern usage, the upper house of a legislative body is commonly called the senate.

SENATE OF THE UNITED STATES. See CONGRESS OF THE UNITED STATES.

SEN'ECA. A leading tribe of the great Iroquois Federation known as the Five Nations, the Seneca Indians inhabited a large section of Western New York between the Genesee River and Seneca Lake. About 1650-60, after subduing the Erie tribe and the Neutral Nation, the Senecas expanded westward beyond Lake Erie and southward along the Allegheny River. The tribe supported the British during the French and Indian and Revolutionary wars. A Seneca reservation in New York now contains about 2,800 members of the tribe, and a few are found in Oklahoma and Ontario. See FIVE NATIONS, THE.

SENECA, LUCIUS ANNAEUS (about 4 B. C.-A. D. 65). French classic drama and the theater of Shakespeare's time were greatly influenced by Seneca, a Roman writer of the Stoic school. Besides ten tragic dramas which were neither intended for nor adapted to the stage, he wrote a number of famous moral essays, among which are *Anger, Providence, Tranquillity of Mind, Constancy of the Wise Man, Clemency,* and *Benefits.*



NERO'S TUTOR

The stoic Seneca is remembered chiefly for his treatises on philosophy, but during his lifetime all his writings were popular.

Born in Cordova, Spain, the young Seneca received a good education, and traveled extensively. He rose to the position of quaestor, but was later banished to Corsica by the Emperor Claudius. He was recalled after eight years by Agrippina and became praetor as well as one of the teachers of the young Emperor Nero. Seneca at first had some beneficial influence on Nero, but their later association was clouded by hate and jealousy. Seneca was accused of a conspiracy by Nero, and was forced to commit suicide.

SENEGAL, *sen' eh gawl,* **REPUBLIC OF,** is a country formed from French West Africa. It faces west on the Atlantic Ocean, and is bounded by the republic of Mauritania, Sudanese Republic, the republic of Guinea, and Portuguese Guinea. British Gambia pierces its central portion like a sliver for 200 miles. Senegal's area is 80,600 square miles, and its population is about 2,270,000. Its capital is Dakar. Senegal became independent June 20, 1960, and formed with the Sudanese Republic the Mali Federation. Senegal later seceded from the federation. It had been self-governing since 1958. Products include gums and oils, peanuts, millet, corn, sheep, goats, cattle, and minerals. Dakar is a chief stop on South American-European airlines.

SEN'SES. When we touch a hot needle to the finger, we feel pain and heat. That is because the needle touches certain nerve endings in the finger, which carry the stimuli of pain and heat with lightning-like rapidity through the nervous system to a special portion of the brain where these stimuli are registered and translated into sensations of pain and heat.

The human body contains at least eleven of these senses, each with its own special organs, nerves, and brain centers which respond to certain stimuli only. These senses are: touch, heat, cold, pain, the muscular sense, taste, smell, hearing, sight, thirst, and hunger. Stimuli to the eye are translated into sensations of light; stimuli to the ear, sound; stimuli to the skin, touch, heat, cold, or pain; stimuli to the taste buds, taste; stimuli to the muscles, sensations of body position and movement.

It is possible to produce sensations directly without involving the special sensory organs. For example, by stimulating the auditory and optic nerves with an electric needle, we get the impression of sound and light without having the stimuli pass through the ear or eye.

Some senses are stimulated by only a few impulses; others by many. The skin sensory endings, some of which react to heat, some to cold, some to pain, and some to touch, respond to many stimuli, as do those of the ear, eye, muscles, and smell organs. Taste nerve endings respond to only four stimuli—bitter, sweet, sour, and salt.

When we touch a flower, we receive several stimuli—sight, smell, and touch. These stimuli are separately communicated to the brain, but the brain combines all the resulting sensations so that we perceive the flower as a whole and not as several separate sensations.

Consult the following titles for additional information:

Ear
Eye
Nervous System
Smell
Taste
Touch

SENSITIVE PLANT. Although there are many plants of a sensitive nature, such as the insectivorous plants and the touch-me-nots, the mimosa of South America is the true sensitive plant. When this thorny, Brazilian weed is disturbed or shaken, it folds its leaves over one another in pairs, the leafstalks bending toward the stem. The leaves, if left undisturbed, will gradually unfold again.

SE'PIA. The brown pigment called sepia comes from certain species of cuttlefish. As the coloring is taken from the ink bag of the fish, it is jet black, but it is changed to brown when treated with caustic alkali and acid. After boiling and filtering, this mixture is the sepia used in water colors. The black sepia is also used to make drawing ink. See CUTTLEFISH.

SE'POY REBELLION. When the British ruled India, a group of Sepoys (Indian soldiers in the British army) rebelled when their officers tried to introduce Western ideas that conflicted with their native customs and beliefs. Started at Meerut in May, 1857, the uprising spread rapidly, and hundreds of Europeans were murdered before it was crushed by British troops.

The Hindu religion prohibits the tasting of any product of pig or cow. Consequently, when officers of the British East India Company, who then controlled India, ordered the natives to bite the patches from greased cartridges, the natives refused. Some of the Sepoys were imprisoned for refusing to use the hated bullets, and the rebellion burst into flame. Meerut, Delhi, Cawnpore, and Lucknow were stained with the blood of British men, women, and

RAISING THE SIEGE OF LUCKNOW
After severe fighting, the troops of General Sir Colin Campbell were able to rescue the British garrison of Lucknow, isolated by the Sepoy Rebellion of 1857.

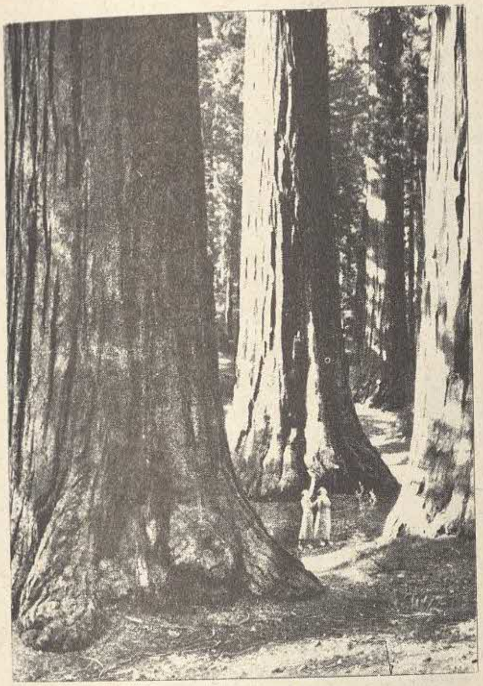
children. It was the following June before order was restored. The rebellion convinced the East India Company that it could no longer handle the situation, and the government of India was turned over to the Crown.

SEPTEM'BER. The ninth month of our year, September was the seventh month in the old Roman calendar. Its name is derived from the Latin word for *seven*. Julius Caesar revised the calendar and September became the ninth month but retained its name. It has thirty days.

September is a glorious combination of summer and autumn. The foliage of the trees turns into a blaze of color, but the days are full of glowing warmth. About September 23rd comes the autumnal equinox, when the sun crosses the equator toward the Tropic of Capricorn. On this date and on March 21 (the vernal equinox), days and nights are approximately equal the world over. September flowers include the fringed gentian, wild aster, and dahlia. The flower of the month is the goldenrod; the gem, the sapphire.

SEQUOIA, *se ḳwoi' a.* Probably the oldest living things on earth are the sequoias, giant trees growing on the western slopes of the Sierra Nevada Mountains in California and on the Coast Range of Northern California and Southern Oregon. Some of the finest specimens are found in Yosemite National Park and in Sequoia National Park.

There are two species of sequoias, the



VETERAN GIANTS
Older than the pyramids of Egypt, the Sequoias are the oldest and largest living things.

big trees and the *redwoods.* The big trees are truly of huge size, varying from 275 to 325 feet in height. Many of them are believed to be from 2,500 to 3,000 years old. The trunks of these giants often exceed twenty-five feet in diameter and taper gradually upward, limbs seldom appearing until a height of 125 feet from the ground. The bark of the big trees is usually about a foot thick and of reddish color. It burns poorly, thus protecting the tree from possible damage from forest fires. The trees have short, thick branches which divide and bear short, flat leaves closely crowded together. The cones of the big trees are about two inches long and one and one-half inches in diameter; they contain a multitude of tiny seeds. Big-tree wood is soft and somewhat reddish in color.

So large are some of the big trees that through the base of one in Mariposa Grove there has been built a roadway large enough to accommodate the largest trucks. The stump of another has been made into a dance pavilion large enough to hold twenty couples, a complete orchestra, and a number of spectators. One of the fallen trees has had the heart burned out, and a horseman may ride through the trunk for ninety feet, emerging where one of the great limbs has snapped off.

Redwood trees are found chiefly along the Coast Range of Northern California and Southern Oregon. They, too, reach a height of 250 to 300 feet, although their diameters seldom exceed fifteen feet. Easier to cut and transport than are the big trees, they are rapidly being depleted and are the chief timber source west of the Rockies. Unlike the big trees, the redwoods reproduce by sending out suckers from the root system.

Sequoias are named for Sequoyah, a half-breed Cherokee Indian who devised an alphabet for his tribe.

SERBIA, *sur′bi a.* Until 1914 mountainous little Serbia was an independent kingdom in the Balkan Peninsula of Europe. Its people had enjoyed independence only since 1878, when, by a series of revolutions, they had thrown off the Turkish yoke. By the fateful year of 1914 the Serbians had just begun to adjust themselves to the new order of freedom and liberty, when there occurred an event which was destined to deprive them not only of their independence but their identity as well. In June, 1914, the heir to the throne of Austria-Hungary was assassinated at Sarajevo in Bosnia, the event which brought about the First World War. Claiming that Serbia was agitating against the Dual Monarchy, Austria-Hungary declared war on the little kingdom a few weeks later.

Shortly after the start of the conflict, Serbia was overrun by German and Austrian troops; and within a year it had been completely occupied. With the restoration of peace in Europe, Serbia joined with other Slavic countries to form the new nation of Yugoslavia.

The history of Serbia began in the seventh century A. D. Before long, Serbia came under the control of the Byzantine Empire.

Ewing Galloway

SYMBOL OF SLAVIC UNION

The Royal Palace at Belgrade from which the youthful King Peter II ruled the Serbs, Croats, and Slovenes before World War II forced him into exile. Serbians are numerically the strongest element in the postwar Yugoslavia.

SERB PEASANTS OF OBRENOVAC

The old tribal customs which long governed the Serbs are now giving way to advanced ideas.

By the twelfth century, however, the country had achieved its independence, and in the middle of the fourteenth century Prince Stephen Dushan conquered Macedonia, Albania, Thessaly, and parts of Greece and Bulgaria. He had himself made emperor of Serbia. After his death in 1355, the country was broken up; and in 1389 the Turks invaded and conquered Serbia. Much of the country was acquired by Austria in 1718 under the Treaty of Passarowitz. A few years later, however, under the Treaty of Belgrade, Serbia was again under Turkish rule. Early in the nineteenth century the Turks were driven from the country, but in 1813 they regained control.

Up to 1878 the country was ruled by monarchs who were subservient to the sultan of Turkey. During the Russo-Turkish war in 1877, Serbia again rebelled. The Congress of Berlin, in the following year, established Serbian independence. Serbia was once more at war with Turkey in 1912 and a year later became involved in a conflict with Bulgaria. The Treaty of Bucharest in 1913 increased Serbia's territory by the addition of much of Macedonia.

World War I brought Serbia's downfall. King Peter was forced to move his court to Greece in 1915, after the capture of Belgrade, the capital. In 1918 he abdicated in favor of his son Prince Alexander, who became regent.

For additional details, see YUGOSLAVIA.

SERFS. See FEUDAL SYSTEM.

SERGEANT, *sahr'jent.* See RANK.

SERGEANT-AT-ARMS. Nearly every legislative or deliberative body has as one of its officers a sergeant-at-arms whose duty it is to keep order and to carry out the officers' orders. In legislative bodies, his symbol of authority is the mace.

SER'PENT. See SNAKE.

SE'RUM THER'APY. One of the greatest advances ever made in the field of medicine is the use of serums injected into the blood of a person or animal to render him immune from a disease, or to assist him in throwing off a disease already acquired. This treatment is known as serum therapy.

Serums are usually made by injecting a few disease germs, such as those of diphtheria, into the veins of a horse. Gradually the dose is increased until large amounts can be given without harm. An antitoxin, meaning *against a poison,* has thus been set up in the body of the animal, enabling him to resist the infection. After the proper time has elapsed, blood may be withdrawn from the animal and used on human beings to prevent the disease. Antitoxin serums for tetanus and other diseases may be produced in a similar manner.

Serums are of two kinds, *antitoxic* and *antibacterial.* The former group wars against the toxins set up by the invasion of the germs. The latter act directly against the bacteria themselves, killing or rendering them harmless. See GERM THEORY OF DISEASE.

SERVICE, ROBERT WILLIAM (1874-1958). His vigorous, exciting stories and poems of the Canadian Northwest gave Robert W. Service a prominent place in Canadian literature. His writings have a genuine appeal to everyday people because of their simple, direct style and because they portray everyday life.

Service was born at Preston, England, and was educated at Glasgow. In 1905 he emigrated to Canada. He joined the staff of the Canadian Bank of Commerce and served that institution in its branches at White Horse in the Yukon and at Dawson City. During World War I he spent two years as an ambulance driver in France.

Service's volumes of verse include *The Spell of the Yukon, Songs of a Sourdough, Ballads of a Cheechako, Rhymes of a Rolling Stone,* and *Rhymes of a Red Cross Man.* His novels include *The Pretender* and *The Trail of '98.*

SE'TON, ERNEST THOMPSON (1860-1946). Well known to nature lovers is the name of Ernest Thompson Seton, noted artist, writer, and lecturer on birds and animals. Born in Shields, London, he was brought to Canada at an early age, spending much of his time on the plains and in the backwoods of the Dominion. He was educated at the Toronto Collegiate Institute, and the Royal Academy in London, and devoted six years to art study in Paris. In 1891 he was appointed official naturalist for the province of Manitoba. He also was one of the chief artists on the staff of the *Century Dictionary,* and illustrated many books on nature.

In 1902 he founded the Woodcraft Indians, a boys' organization that later became identified with the Boy Scout movement, originated by Daniel Beard. Some of his writings include *Wild Animals I Have Known, The Biography of a Grizzly, Lives of the Hunted, Monarch, the Big Bear, Lives of Game Animals,* and *Animal Heroes.* Although some naturalists have seriously questioned his observations on animal life, his stories have aroused keen interest in the study of animals and their habits.

SET'TER. When hunters take to the woods in the fall in search of grouse, they are often accompanied by excellently trained dogs which do exactly as they are told. When they are given permission, they work their way through underbrush, their tails straight out behind. Occasionally they locate a bird, and when this happens, the animals "freeze" in their tracks, with their noses pointed at the bird which the hunter hopes to shoot.

Setters are medium-sized dogs with plumed tails and silky hair. *English* setters are the largest and lightest-colored. They are also more generally popular. English setters are mostly white with markings of black, tan, or liver color. *Irish* setters are, when well trained, sometimes even better than the English setters. Irish setters are uniformly mahogany-brown in color. They are prone to be more nervous

BREED FAVORED BY SPORTSMEN
Setters are alert, faithful, and intelligent. Left, below, an Irish setter. Below, right, group of Irish, Gordon, and English setters.

and high-strung than either English setters or the third kind, the *Gordon* setters. Gordon setters are glossy-black dogs with tan markings. They are better known in England than in America.

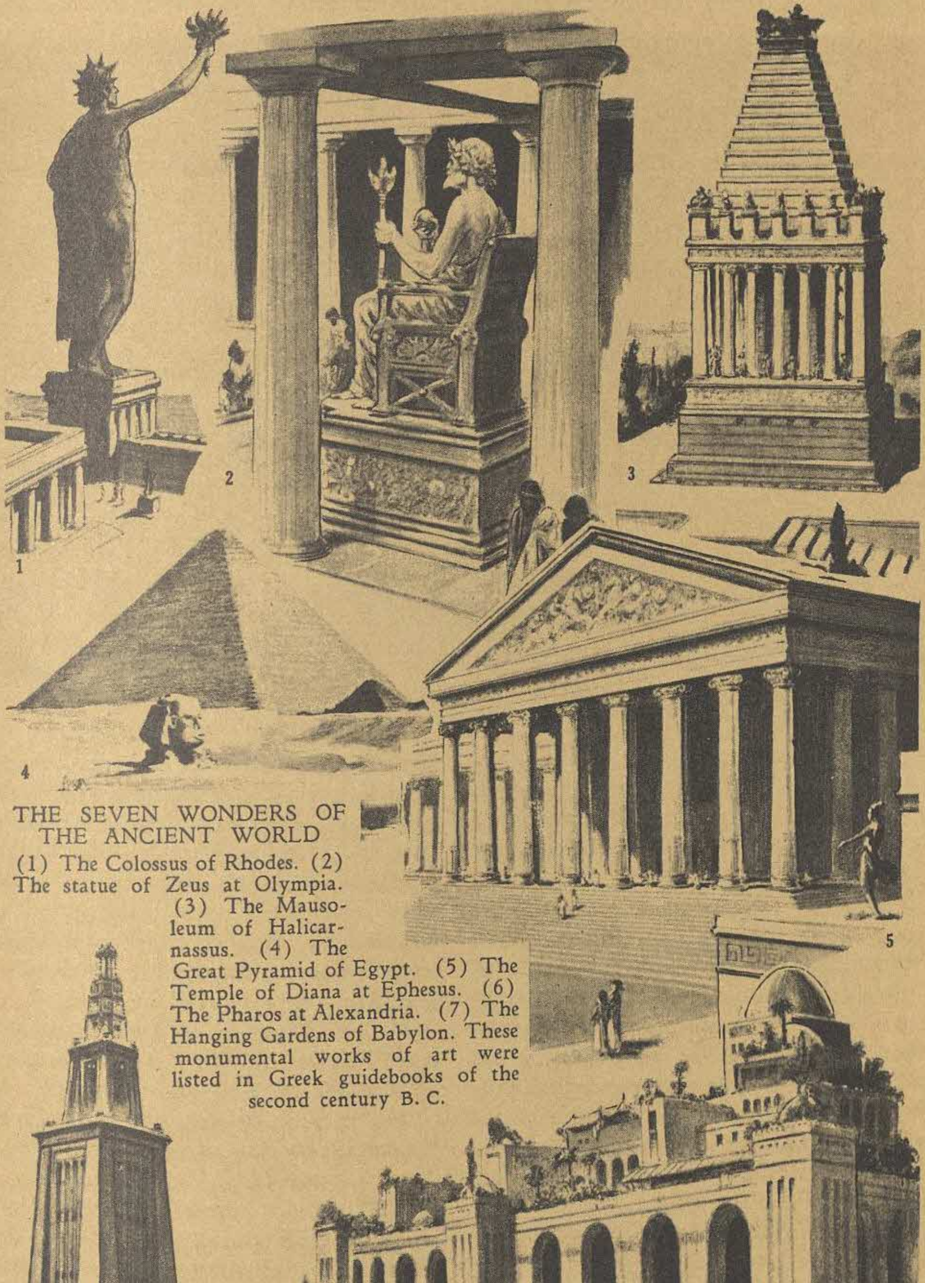
SEVENTEEN-YEAR LOCUST. See CICADA.

SEVEN WEEKS' WAR. In the summer of 1866, Prussia and Italy went to war against Austria and her Germanic allies as a result of a plan by Bismarck to form a united German nation under Prussia's leadership. Seizing upon the reorganization of the German Confederation and the status of Schleswig-Holstein as causes for war, the Prussians forced the issue and invaded Bohemia. At no time did the Austrians offer serious resistance, and following the Battle of Sadowa, they were forced to sue for peace. Under the terms of the Treaty of Prague, Austria was treated with consideration, her only loss being Venetia, which was given to the Italians. Schleswig-Holstein was annexed by Prussia, which became the dominant German state.

SEVEN WONDERS OF THE ANCIENT WORLD. Remarkable tests of ancient man's engineering ability and artistic creative powers were the so-called Seven Wonders of the Ancient World. Only one of these, the group of pyramids in Egypt, remains, but from descriptions of classic writers, the world has learned about the other six. The Seven Wonders are: The pyramids of Egypt; the Hanging Gardens of Babylon; the statue of Zeus at Olympia; the Temple of Diana at Ephesus; the Mausoleum of Halicarnassus; the Colossus of Rhodes; and the Pharos, or lighthouse, at Alexandria. See COLOSSUS; HANGING GARDENS OF BABYLON; PYRAMIDS.

SEVEN YEARS' WAR. In respect to territory involved, the Seven Years' War was a world-wide conflict, for its battles took place in North America, Asia, and Europe. Lasting from 1756 to 1763, it involved all the major nations of Europe, settled the destiny of France and England in America and India, raised Prussia to the rank of a first-rate power, brought England supremacy on the seas, and placed Frederick the Great among the world's outstanding military geniuses.

The actual cause of the war was the desire of Maria Theresa of Austria to regain Silesia, which had been seized by Frederick II of Prussia after his accession in 1740. England became an ally of Prussia because any war involving Prussia and Austria endangered Hanover, ruled by George II of England. Besides, England already was at war with France by the time Prussia and Austria commenced hostilities. France joined Austria because she sought the Netherlands and certain areas along the Rhine. Russia also cast her lot with Austria because she wanted Courland and a division of Prussia. Sweden became another ally of Austria for the purpose of expanding her territory in the Baltic region, and



THE SEVEN WONDERS OF THE ANCIENT WORLD

(1) The Colossus of Rhodes. (2) The statue of Zeus at Olympia. (3) The Mausoleum of Halicarnassus. (4) The Great Pyramid of Egypt. (5) The Temple of Diana at Ephesus. (6) The Pharos at Alexandria. (7) The Hanging Gardens of Babylon. These monumental works of art were listed in Greek guidebooks of the second century B. C.

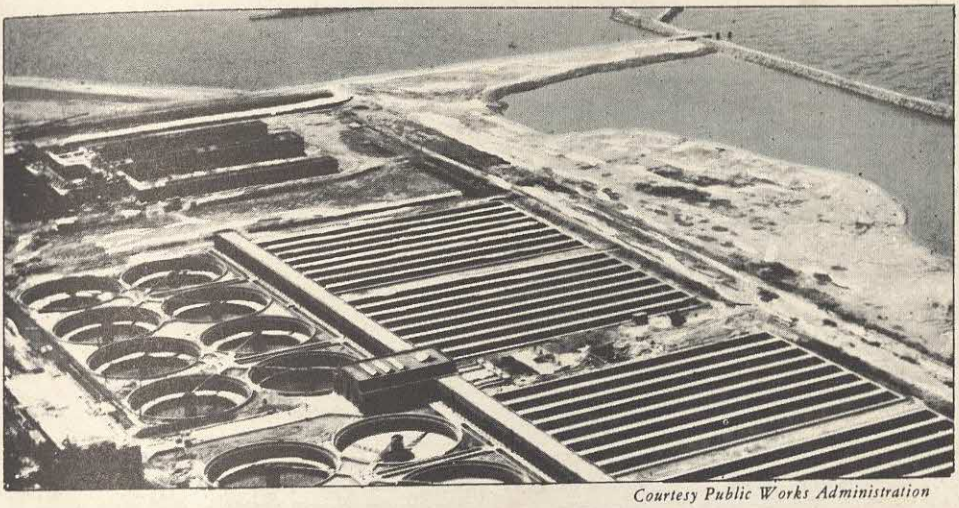
THE PRUSSIAN ASSAULT AT LEUTHEN
In a costly battle at Leuthen, the Austrians lost well over a third of their army.

Poland was involved because Saxony, a key territory, was ruled by her king, Augustus II. Spain was brought in later as an ally of France. The war thus found England and Prussia pitted against the rest of Europe.

The struggle began when Frederick the Great, fearing Austria's designs on Silesia, invaded Saxony, which was friendly to Austria. He was successful, and Saxony remained his base of operations throughout the duration of the war. During the first two years of the war, the British rendered little aid because England was engaged in a struggle with France in India, North America, and on the sea. Not until the elder William Pitt came to power in 1758 was England a strong factor in the war.

Frederick, realizing the powerful alliance against him, struck telling blows, however, and won important victories at Rossbach and Leuthen. Then, in 1758, when Pitt's vigorous foreign policy began to bear fruit, England gave more vigorous support. Frederick defeated the Russians at Zorndorf, but was beaten later at Hochkirch by Austria. In the same year, the English were successful against the French at Krefeld. They had already won an important victory at Plassey, India, in 1757. The year 1759 was a dark one for the Prussians. They suffered a series of defeats, and had only the English victories at Minden and the naval triumph over the French at Quiberon Bay to encourage them.

The next year Frederick won at Liegnitz and Torgau, but with the accession of George III in 1760 and Pitt's fall from power in 1761, Prussia lost her only ally. England, victorious over France in North America and India, withdrew from the conflict. Russia, however, switched her allegiance to Prussia in 1762, when Peter III came to the throne, and even though Catharine II deposed him, the valuable assistance of Russia was withdrawn from Austria. Sweden, too, withdrew, and, late in the year, Prussia and Austria reached a truce. Spain had been drawn into the war a year before and was suffering defeats in the West Indies. The result was that on November 3, 1762, England, France, Spain,



Courtesy Public Works Administration

MODERN SOLUTION OF AN OLD PROBLEM

The concentration of population has entailed a careful study of the problem of sewage disposal. This modern treatment plant at Cleveland was built to safeguard community health.

and Portugal signed the Treaty of Fontainebleau.

On February 15, 1763, Prussia and Austria signed the Treaty of Hubertusburg, in which Prussia retained Silesia. The Treaty of Paris, signed five days earlier, gave England the French colonies in North America and India. Spain received Louisiana from France, but gave Florida and the land east of the Mississippi to England. The American phase of the war is known as the French and Indian War. See FRENCH AND INDIAN WARS.

SEWAGE, *su'aj,* **AND SEWAGE DISPOSAL.** With the growth of large cities, the sanitary disposal of sewage from homes and factories has become a difficult engineering problem. Sewage is composed of various solid and liquid waste products, such as human excreta and industrial wastes, combined with sufficient water to carry away the material. Sewerage is the system of pipes and drains which carry the sewage to the point of disposal.

The correct and prompt disposal of sewage is vital to the health of the community. In many rural areas there is no central disposal system, and each farm and home disposes of its wastes in the soil. If this is done in such a way as to avoid contaminating the water supply and to prevent the breeding of disease-carrying insects, there is little objection to the method.

In cities and towns, however, some other method must be adopted. In general, all sewerage systems consist of networks of large drains which carry the refuse to a point where it is not dangerous to the community. There must be plenty of water to carry away the sewage, and in many places the system is so arranged that surface water from storms will help in the task, but since this method leaves the sewers open part of the time and allows the escape of poisonous gas, it is more desirable to have the drainage and sewerage systems separate.

Sewerage systems are composed of small iron, brick, or terra-cotta pipes which conduct the waste products from residences and business establishments to the large main iron or brick conduits which carry the waste to the point of disposal. One of several methods of disposal is used, and in some cities various means are employed. The sewage may be run into a river or lake, it may be distributed over the soil at some point outside the city, or it may be treated in a sanitary disposal plant.

In the first case, purification takes place slowly through settling and action of the water, but there is the danger of contamination. Sewage is purified on the soil by the action of the sunlight and air. The most common method used in large cities is dumping into a river or lake after purification in a disposal plant by chemical action, filtration, and aeration.

SEWING MACHINE. Elias Howe received the first sewing machine patent in 1846. Such inventions before Howe's were unsuccessful or went without patents.

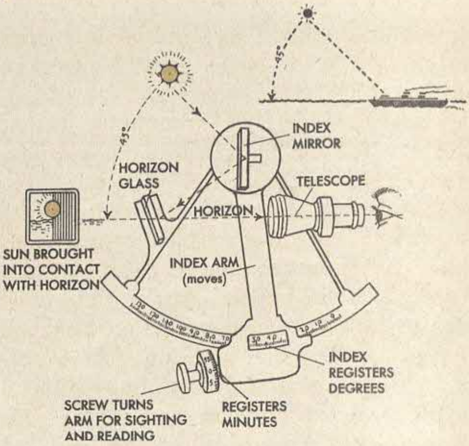
Howe's machine consisted of a needle with an eye near the point. Below the cloth was a vibrating shuttle containing a spool of thread called the bobbin. As the needle was forced through the cloth by a special mechanism, the lower thread was carried through the loop made by the upper thread and was tightened against the cloth, forming a lock stitch. Later improvements moved the cloth automatically and the machine was operated by foot power. Previous models were turned by hand.

Modern Sewing Machines. Double-thread machines, the variety in widest use, make lock stitches. Single-thread machines create chain stitches, but have the disadvantage of greatly weakened seams if the thread should break. Modern machines offer new types of needles or special attachments that permit fancy stitches. Some machines are specialized to meet various needs of industry.

SEX'TANT. A modification of an ancient astronomers' instrument, a sextant is a device used in navigation to measure the angle between the horizon and the sun (or a star or the moon).

Wherever a ship or plane may be, the sun appears at a different height in the sky than it would at the equator. The navigator uses the angle (elevation or altitude) furnished by the sextant together with information from the *Nautical Almanac* or *Air Almanac* to find his latitude and longitude.

In the famous "noon sight," which has been used for hundreds of years, the navigator "shoots the sun" at its greatest altitude, at noon. If he takes several readings at short intervals at midday, the highest one is exactly at noon, "sun time." His chronometer (ship's clock) or his radio tells him the exact time at Greenwich. The difference tells him his longitude.



SHOOTING THE SUN

Highly simplified diagram shows use of sextant, as described in article, to find position.

The sextant has a triangular frame, forming one-sixth of a circle, which accounts for the name of the instrument. A sighting tube or telescope is attached to the frame. A fixed mirror is in the line of sight and at the circle's center a movable mirror adjusts with an arm. A scale measures the angle between the two mirrors. Through the tube, the navigator sees the horizon, and moves the arm until the reflected image of the sun or star from the movable mirror touches the horizon, alongside the fixed mirror. When the mirrors are parallel, the reading is zero, and the direct and reflected images coincide. The angle between the horizon and the sun or star can be read in degrees and minutes on the scale. In the better sextants, a *vernier,* or finely graduated scale, is attached to the regular scale. With a magnifying glass, the vernier can be read to ten seconds of arc, or about one sixth of a mile.

The divisions on the scale are called degrees. However, each scale degree is only half an actual degree because the angle through which the arm is moved is only half the actual angle to be measured.

A sextant with a six-foot radius was used in 1670 by astronomer Johannes Hevelius.

It was "miniatured" for hand use in a series of changes made by Sir Isaac Newton in 1672 and Thomas Godfrey and John Hadley in 1730. Modern variations of the sextant adapt it for use in airplanes, submarines, and during bad weather.

In airplanes the *bubble sextant* usually is used. The horizon is established by a levelling bubble or pendulum. *Link's sextant* uses a spherical bubble as an artificial horizon. Moving the arm brings an S-shaped image into the center of the bubble. Squeezing a trigger records the setting by a pencil mark on a plastic drum. Several readings within a few seconds can be averaged and read with the vernier at leisure. By means of gears, one revolution of the drum equals five degrees of altitude. The drum, vernier, and bubble are lighted by batteries.

The *ball sextant* was invented by Frederick H. Hagner of San Antonio in 1939. The hanging vertical tube forming the index arm contains nine small steel balls. The observer sights on the S-shaped image. Then by squeezing the trigger he drops the balls one at a time onto a frosted glass covered with carbon cloth. The average position of the resulting dots indicates true vertical. The observations can be made and averaged in one minute.

The *radio sextant* has an antenna three feet or more in diameter, which can pinpoint the sun, even through heavy clouds.

The *periscope sextant* can operate through the snorkel tube of a submarine. It is set approximately, by hand, to view the desired star. Then it focuses electronically by remote control.

Thomas Summer devised another method of determining location. He observed a star with the sextant. Then, using the point on earth directly below the star (the substellar point as found in almanacs) as the center and the star's altitude as the radius, he drew a circle on a globe. Repeating this from another star gave him two widely separated intersections, one of which was the observer's position. A third circle indicated which one. This method is a quick one but it is not very exact. It was revived by Drury McMillen of Brazil in 1939. See COMPASS; DECLINATION; LATITUDE; NAVIGATION.

SHACKLETON, *shak' 'l tun,* ERNEST HENRY, SIR (1874-1922). Born at Kilkee, Ireland, explorer Ernest Shackleton attended Dulwich College. He served in the merchant marine and the Royal Naval Reserve. In the *Nimrod* he headed an Antarctic expedition in 1908, and reached a point less than 100 miles from the South Pole before terrific winds and lack of supplies forced him to retreat. Upon his return to England, he was knighted. Shortly thereafter he published an account of his thrilling experiences in *The Heart of the Antarctic.*

In 1914 Sir Ernest set sail on his last Polar voyage. His ship, the *Endurance,* was crushed by ice and the party survived by taking to the icy sea in open boats. They were picked up and reached England in 1917.

SHAD. The shad spends half of its life in the ocean, and in the spring its ascends rivers to spawn. The eggs are called shad roe, a food delicacy. The shad, which weighs from three to twelve pounds and has no teeth in its jaws, is silvery white on the sides and under parts, and bluish above. Its native habitat is the Atlantic coast of the United States but it has been introduced in great numbers along the Pacific coast.

SHAD FLY. See MAY FLY.

SHADOW. See LIGHT.

SHAH JAHAN, *shah je hahn'* (1592-1666). See TAJ MAHAL.

SHAKERS, *sha' kurz,* or **SHAKING QUAKERS.** Members of the United Society of Believers in Christ's Second Appearing commonly are called Shakers because of fervor expressed in their church services. The sect began in Manchester, England, in 1747, as an outgrowth of a Quaker revival. In 1774 Ann Lee led a group of followers to the United States. In 1787, three years after her death, a communal settlement was organized at Mount Lebanon, N.Y.

All property is held in common, and all bind themselves to share the group's work. Men farm or learn trades, and the women work in the homes. Shakers do not approve of marriage, and men and women live in separate quarters, even though married. Public confession of sins is required for admission as a Shaker. The members do not believe in wars. No jewelry is worn, and no ornaments or decorations are permitted in the homes. The spirit of God is supposed to have been revealed in a peculiar way through Jesus Christ and Ann Lee, but neither of them is worshiped. The number of Shakers is very small.

The World's Poet

"BID ME DISCOURSE, I WILL ENCHANT THINE EAR"

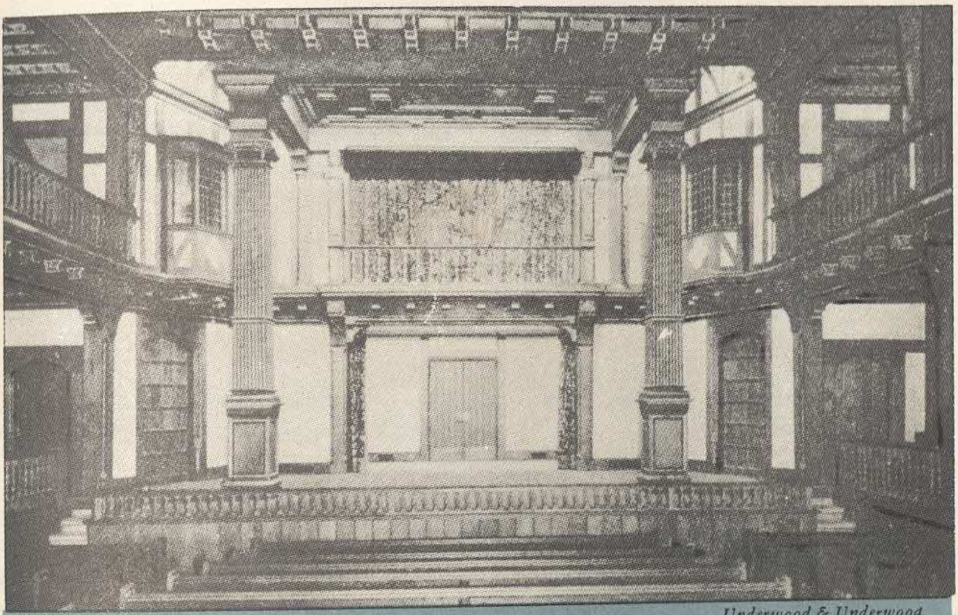
Unique indeed was the genius which enabled Shakespeare to interpret such a great range of human experience. Above, left, the "Chandos Portrait" of the poet. Right, his birthplace.

SHAKESPEARE, *shayk'speer,* William (1564-1616). Greece claims Homer; Italy boasts of Dante; and Germany honors Goethe. But William Shakespeare, who was born and who died in tiny Stratford-on-Avon, England, belongs to all the world. No other name in literature is so honored as his. No other writer's fame is so widespread. He is considered the greatest interpreter of human nature ever to put pen on paper; a poet whose graceful meter and eloquent expression are timeless; and a dramatist who has dominated the theater for more than 300 years.

His Life and Career. Despite Shakespeare's fame, little is known about his life. We know that he was the son of John and Mary Shakespeare, who were fairly well-to-do, that he was the third of eight children, and that he presumably received a good grammar-school education. We also know that when he was eighteen he married Anne Hathaway, a woman eight years older than himself; that he had three children—Susanna, born 1583, and twins, Hamnet and Judith, born 1585; that he left Stratford about 1585; that he wrote more than thirty plays and a collection of sonnets and other poems; and that he returned to Stratford, where he died at the age of fifty-two.

Because of the gaps in his career, many legends have grown up about him. It is said that he was forced to leave Stratford because he had poached in the park of Sir Thomas Lucy. It is even held by some people that he did not write the plays ascribed to him, that they were actually the work of Francis Bacon or of others. The world is not even sure how his name was spelled, for it appeared in many variations, such as *Shakspere, Chackspere,* and *Shakespere*. These stories, however, cannot be proved; and, as far as his name is concerned, the spelling *Shakespeare* appears on most of the documents mentioning him.

On the basis of his writings and contemporary documents, it is safe to venture



Underwood & Underwood

AS IN THE DAYS OF ELIZABETH

This faithful reconstruction of an Elizabethan playhouse may be seen in the Folger Shakespeare Memorial Library in Washington, a treasury of Shakespeareana and contemporary literature.

that in London he soon became well known as a playwright and actor, for in 1592 he was mentioned by a fellow writer, Robert Greene. The following year his *Venus and Adonis,* a poem dedicated to the Earl of Southampton, was published; and in 1594 another famous poem, *The Rape of Lucrece,* appeared, also dedicated to the Earl of Southampton. Shakespeare apparently was well off financially, for in 1597 he purchased a home at Stratford-on-Avon called New Place. Twelve of his plays and "sugared sonnets" are mentioned in a book written by Francis Meres in 1598; and in that same year the list of actors for Ben Jonson's *Every Man in His Humour* contains his name. He was a shareholder in the Globe Theater, according to records of 1599, and purchased more property in Stratford a few years later.

On April 23, 1616, Shakespeare died. The cause of his death is not known. On his tombstone in the chancel of Trinity Church, in Stratford, is an epitaph said to have been written by him, reading:

> Good frend, for Iesus sake forebeare
> To digg the dust encloased heare;
> Bleste be ye man that spares thes stones,
> And curst be he that moves my bones.

His good friend, Ben Jonson, said of him: "I loved the man and do honor to his memory, on this side idolatry, as much as any. He was indeed honest, and of an open and free nature, had an excellent phantasy, brave notions, and gentle expressions."

The Plays. Shakespeare's plays were immediately popular with his audiences, and he is mentioned in court records as having produced dramas before Queen Elizabeth and other members of royalty and nobility. The fact that most of his plays can be presented today on modern stages, in modern dress, and can still be as much appreciated as they were when written, is evidence of Shakespeare's genius. It must be remembered, however, that the plays were written to be acted on a small stage with few of the facilities of modern theaters, and that the people of the times expected to be en-

FROM AN HISTORICAL DRAMA
The abdication scene from Shakespeare's *Richard II,* a drama of a contest for England's throne.

tertained with loutish comedy, horror scenes, witches, ghosts, and battles. Shakespeare's plays contain all these factors, but they also contain so much wisdom, beauty, and understanding that they have far outlived the customs of the Elizabethan Age.

Not all Shakespeare's plays are equally good. It must be remembered that Shakespeare wrote a drama on the average of one every six months, that his own mental growth pervaded them, and that external conditions affected his writing. Thus we have his plays grouped in four periods, the first period consisting of those plays written when he was young and inexperienced; the second period consisting of those dealing mainly with history and comedy; the third, when his mental powers and ability were at their height and the bitterness and tribulations of life fascinated him; and the fourth period, when he had achieved the serenity of middle age and a calm and understanding that enabled him to write his last romantic plays.

In the first period, lasting from 1588 to 1595, were: *Titus Andronicus, Henry VI* (Parts 1, 2, and 3), *Love's Labour's Lost, The Comedy of Errors, The Two Gentlemen of Verona, The Taming of the Shrew,* and *Richard III.*

Included in the second period (1595-1600) were: *Richard II, A Midsummer Night's Dream, Henry IV* (Parts 1 and 2), *Henry V, King John, Romeo and Juliet, Julius Caesar, The Merchant of Venice, The Merry Wives of Windsor, Much Ado About Nothing, As You Like It,* and *Twelfth Night.*

The third period, from 1601 to 1608, included: *All's Well That Ends Well, Measure for Measure, Troilus and Cressida, Hamlet, Othello, King Lear, Macbeth, Antony and Cleopatra, Coriolanus,* and *Timon of Athens.*

The fourth period included *Pericles, Cymbeline, The Winter's Tale, The Tempest,* and *Henry VIII.*

PARTING OF FAMOUS LOVERS
The balcony scene from *Romeo and Juliet,* Shakespeare's ever-popular lyrical tragedy.

SHYLOCK, THE IRATE FATHER

A scene from *The Merchant of Venice,* a poetic tragi comedy which has long been one of Shakespeare's most popular plays. Here Shylock laments the flight of his daughter, Jessica.

SHALE. Found in abundance in nearly all regions, shale is a common sedimentary rock. It is almost always too soft to make good building stone, unless it has been altered to a slate. Shale is a consolidated mud and is intermediate between mud and slate in hardness. It occurs in thick formations in the coal regions, and in limestone and sandstone it is found in layers from a tiny fraction of an inch to many feet in thickness. Shale occurring in sandstone regions is often a valuable road material, serving to bind the loose sand together. When shale is pure or mixed with limestone, it is used to make cement. Petroleum is frequently found in bituminous shale.

SHAM'ROCK. There is a great deal of sentiment in the heart of an Irishman regarding the shamrock, but it relates to an idea rather than to any definite plant. Four plants at least—water cress, clover, wood sorrel, and nonesuch—have been known as shamrocks. Some say that the original one was a water cress. Saint Patrick did not think so, if we may credit the legends about him, for he chose the shamrock to represent the belief of the inhabitants of Ireland in the Trinity, and water cresses do not have three-parted leaves.

Some say that Saint Patrick's shamrock was the black nonesuch, which has a three-parted leaf and is a relative of clover. Among the plants sold nowadays on Saint Patrick's Day, in Ireland, England, and America, are the white clover, the lesser yellow trefoil, and the wood sorrel. The wood sorrel is widely sold in the United States and is more decorative than the clovers.

Pliny, the Roman naturalist, tells us that serpents are never seen upon the trefoil, or clover, and it is, therefore, an appropriate emblem for Saint Patrick, who, as the tale goes, drove the snakes from Ireland.

SHANG'HAI, CHINA. Located on the left bank of the Whangpoo River, twelve miles from the mouth of the Yangtze Kiang, Shanghai, in spite of the repeated ravages of modern warfare, still ranks as one of the world's largest cities. Its population is about 7,100,000.

The city was, before World War II, divided into three principal sectors; the native Chinese city, the International Settlement, and the French Concession. In the Chinese section small houses crowd closely upon one another, and the streets are narrow and dirty. In the International Settlement,

Wide World

SHANGHAI IN PRE-COMMUNIST DAYS

The bund and waterfront in Shanghai presented a busy picture before the Communists seized control in 1949. View looks north from Edward VII Street. Weather Bureau tower at right is topped by forecasting equipment.

French, German, British, and American capital built a municipality with fine buildings, paved streets, and the other conveniences of a modern American city. For a time after the Japanese invasion of 1937, the area was under British, French, and American military rule. The Western powers renounced their rights in Shanghai during and after World War II. The city declined in importance after it was seized by the Chinese Communists in 1949.

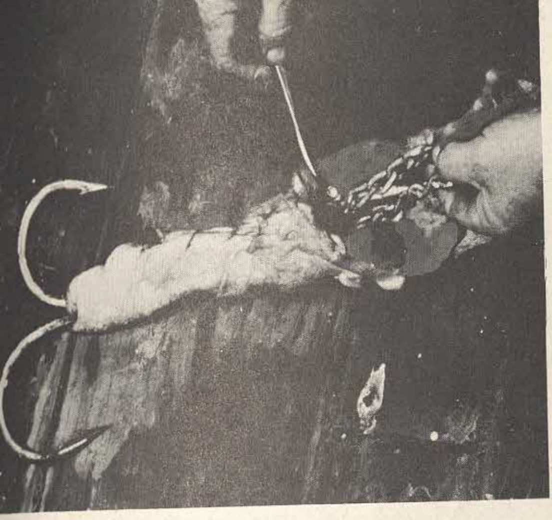
In normal times, Shanghai is the greatest seaport in the Orient. It forms the eastern terminal of the Hangchow and Nanking railroads, and is an important importer of textiles, metal goods, machinery, electrical goods, and petroleum. The chief exports are silk, rice, tea, wool, hides, and paper.

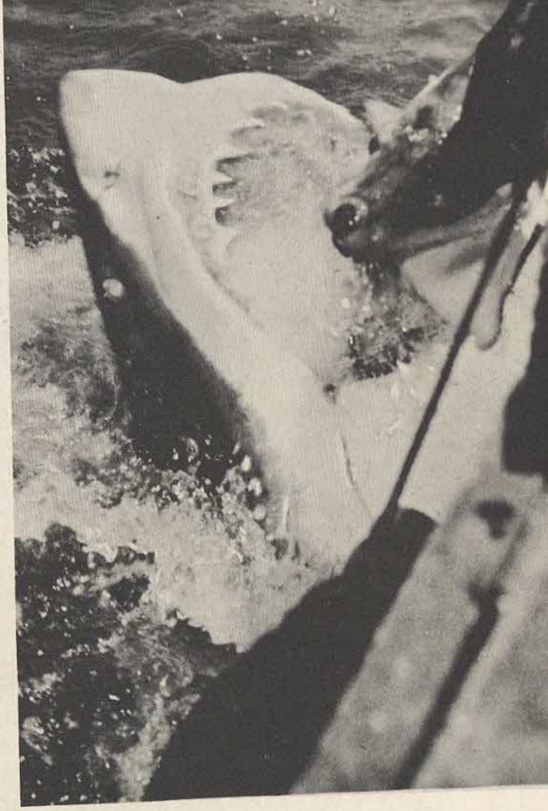
SHAN'NON. Beginning as a tiny stream in Ulster, the Shannon River of Ireland flows in a southerly direction, much of its 250-mile course being formed by a chain of beautiful lakes. As it reaches Limerick it turns southwestward and broadens into an estuary which reaches the Atlantic after a course of sixty miles. The Shannon is Ireland's most important water route and is navigable over most of its course. Its commercial importance is greatly augmented by two canals which link it to Dublin. A hydroelectric plant supplies power for the nearby towns. The fish of the river are a valuable food resource.

SHARK. Although the shark is generally thought to be a man-eater, only the *white,* or "man-eater," shark and a few others of about 150 species are guilty of attacking human beings. In fact, some experts maintain that even the man-eaters will attack only in shallow water. Sharks' bodies are somewhat torpedo-shaped and can rip through the water at tremendous speed, their forbidding dark dorsal fins serving as a warning of approaching danger. The skeleton of the shark is of cartilage rather than bone. Most of the species are covered with a coarse skin called *shagreen,* instead of having the usual coatings of scales. The rough-surfaced skin is sometimes used for polishing wood.

Sharks breathe by means of narrow gill slits. These organs are usually five in number, and occur where the single gills of a fish ordinarily appear. Sharks' mouths, located under the head, are large and vicious, and are armed with several rows of sharp-edged teeth. The beast is not fastidious, for he devours almost anything, living or dead; often he trails behind a ship for days, picking up scraps of food.

The largest shark known to man is the *whale* shark, which often reaches a length of fifty feet. The *basking* shark, though milder in habit, is also large, sometimes forty-five feet long. Two of the varieties most feared are the *white* shark and *hammerhead,* both inhabitants of warm, tropical waters. This latter type is named for the peculiar projection, on either side of the head, resembling the head of a hammer. The eyes are located at the extremities of these projections. Other species

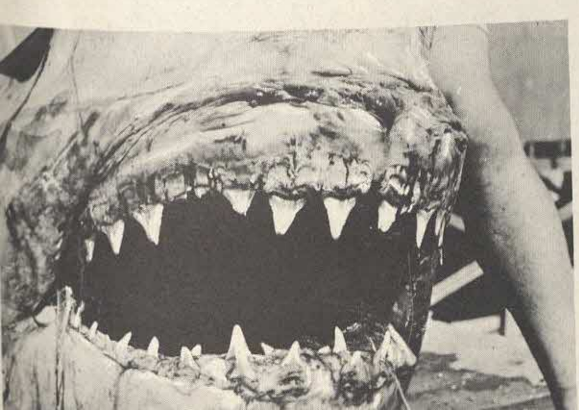


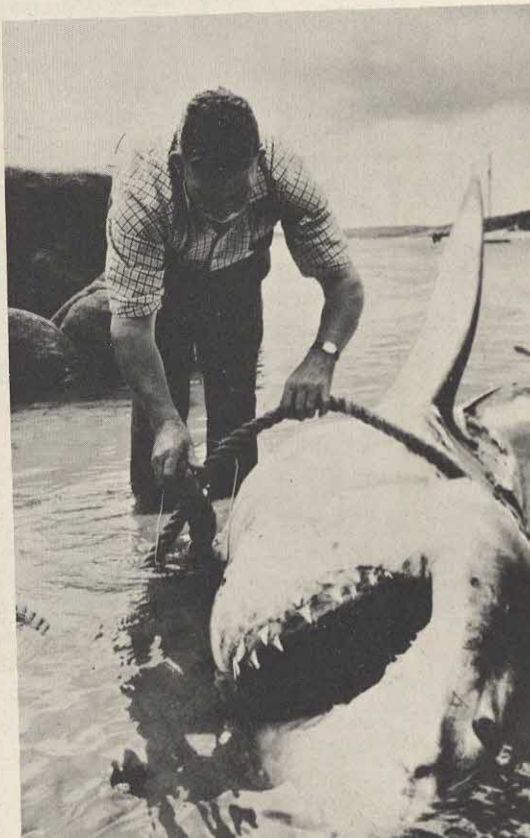


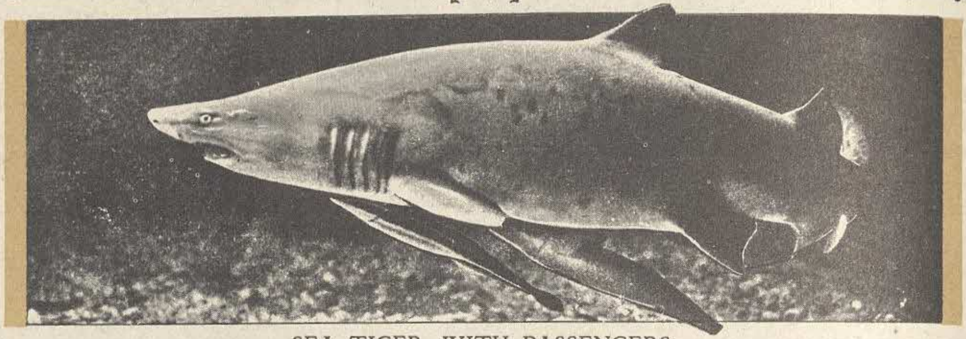
SHARK FISHING IS PERILOUS WORK

Most deep-sea anglers are happy to land a 300- or 400-pound sailfish or marlin. But some veteran Australian shark fishermen are rarely satisfied with man-eaters weighing less than a ton. One expert landed three topping this weight—the largest, 2,536 pounds, was the heaviest fish ever caught on rod and reel. Some sharks are so big that they will charge a boat. Above, shark hooks must be built to withstand a greedy, sharp-toothed bite. Heavy chain serves as a leader between hook and line. The hooks are usually baited with the shark's favorite food—seal liver. Above right, cans of blood and pieces of seal trailed over the side of the boat bring a hungry shark close enough to give an awesome impression of his size. Below, the tooth-barbed mouth of a man-eating shark leaves little doubt of its ability to shear off a swimmer's leg or to kill fish weighing hundreds of pounds. Below right, the battle over, a huge shark lies beached in Australian waters. Largest of the sharks, the *whale shark* and *basking shark*, are not man-eaters. They usually eat small marine animals and refuse bait. The smaller but more ferocious man-eaters are the *white, tiger,* and *hammerhead sharks,* all weighing well over a ton. Sharks are a threat in warm ocean waters the world over.

David Potts from TRUE, The Man's Magazine







SEA TIGER, WITH PASSENGERS

This sand shark has two remoras (sucking fish) attached to it by their large suction discs.

are the *tiger* shark, *spring* shark, *angel fishes, thresher* shark, and *mackerel* shark.

Shark fishing is an important industry. The sharks are attracted to the baited hooks by oil in the water, and it is difficult to land them after they are hooked. Some of the smaller varieties are eaten, but most sharks are caught for their skins. The fins are used by the Chinese as a base for soups. Some sharks are also valuable as a source of oil, made from the liver.

SHAS'TA, MOUNT. Though long inactive and now perpetually snow-covered, Mount Shasta, in the Cascade Mountains of Northern California, was once a fiery volcano. It reaches an altitude of 14,161 feet above sea level. The crater, located on the western of two peaks, is three-fourths of a mile across and bores into the earth for 2,500 feet. Large glaciers cover the northern side of the mountain. See CASCADE RANGE.

SHAW, GEORGE BERNARD (1856-1950). In the first half of the twentieth century England's most distinguished dramatist was George Bernard Shaw, whose biting criticism and brilliant wit gained him a world-wide reputation.

Shaw was a Dublin-born Irishman, but after 1876 he lived in England. There, between 1879 and 1883, he wrote four novels which were published serially in propagandist periodicals. They did not prove a proper vehicle for his talent, and he turned

DISCUSSION IN "SAINT JOAN"

A scene in Shaw's drama: chaplain, bishop, and governor consider Joan's influence.

to drama, where he was at his best. Until 1904 his plays were banned in England, but they were produced in Germany and the United States. It was not the faintly risqué nature of the plays so much as the socialist propaganda they contained which shocked his British contemporaries. Among his most celebrated works are *Candida, Arms and the Man, Man and Superman, Androcles and the Lion,* and *Saint Joan.* For many years Shaw was an active member of the socialist Fabian Society.

SHAW'NEE. Savage and warlike, the Shawnee Indians, an Algonquian tribe, frequently caused trouble in colonial days when white men moved into their territory. They originally inhabited the Savannah River region in South Carolina, but migrated first to New York, then to Indiana and Ohio. Tecumseh was one of their chiefs. Today the remaining Shawnees live chiefly in Oklahoma.

SHAYS' REBELLION. The business depression and financial difficulties which followed the Revolution were the cause of Shays's Rebellion, an uprising which occurred in Massachusetts in 1786-87. It was led by one Daniel Shays, who headed an armed band which prevented the holding of court sessions and in 1787 forced the supreme court at Springfield to adjourn. The rebels were protesting against high taxes, high salaries to officials and exorbitant lawyers' fees, foreclosures of mortgages, and imprisonment for debt. But when Shays and his "army" attempted to capture the local arsenal, the militia was called out and the uprising was at an end. The ringleader escaped to Vermont, but later was pardoned.

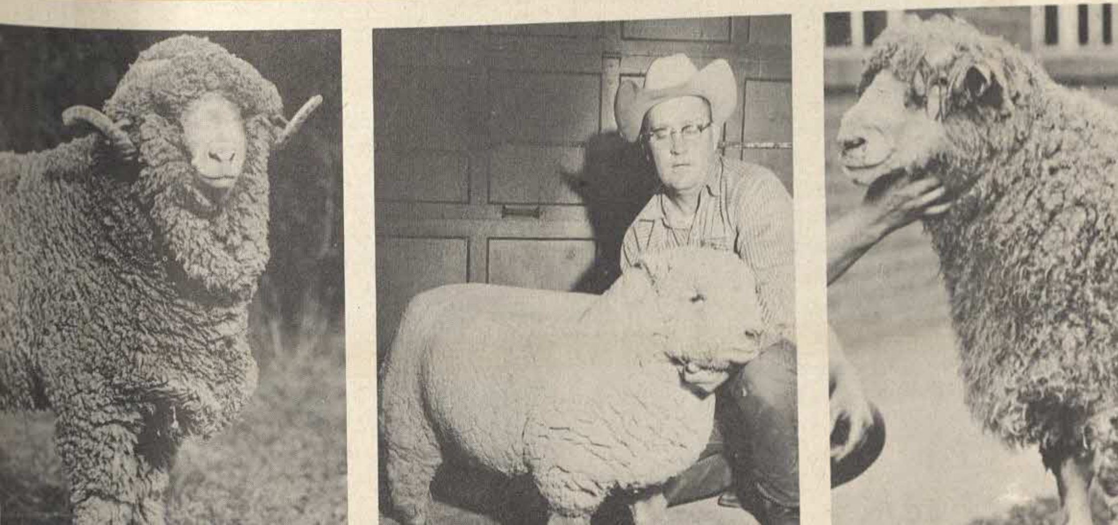
SHEEP. Scattered throughout the temperate zone wherever the growth of grass permits, sheep are among our most important domestic animals. Their wool is made into cloth, their skin into fine leather, and their flesh and milk are important articles of food (see MUTTON; WOOL). Members of the goat family, sheep seem to have obtained their domesticated start in the mild regions about the Mediterranean. They were herded in Palestine and in Greece and Rome, and Spain developed the fine flocks of heavily fleeced Merino sheep which formed the basis of Europe's sheep-growing industry in the nineteenth century.

Characteristics of Sheep. Two outstanding peculiarities of sheep are their preference for mountainous country and their tendency to band closely together in flocks. This latter fact explains why, if one sheep jumps over a fence, the whole flock will be sure to follow. Sheep can thrive in

SOME SHEEP ARE RAISED MAINLY FOR WOOL, OTHERS FOR MEAT

Left, the American Merino is a popular, fine-wooled breed. Center, the Southdown, a medium-wooled breed, is a farm-type meat animal. Right, the Cotswold from England is a long-wooled breed.

U.S.D.A.



areas of scanty grass where cattle would starve, for in grazing they bite the grass off close to its roots. Moreover, they will eat obnoxious weeds that cattle ignore. The growth of wool on the sheep usually amounts to about eight or ten pounds annually, and is sheared from the animal late in the spring after freezing weather has disappeared.

The sheep's worst enemy and best friend is the dog. Well-trained sheep dogs can control a large flock of sheep by running continually about the flock. On the other hand, bands of stray mongrels often play havoc with sheep, getting into the flock and killing several in a single night. Rams (males), ewes (females), and lambs are all at the mercy of dogs, and the best protection for the flock is the addition of several billy goats, who love nothing better than a fight with a dog.

Types of Sheep. There are three general types of sheep: coarse-wooled, medium-wooled, and fine-wooled. The Cotswold, Lincoln, and Leicester are the best of the coarse-wooled breeds, all being characterized by long legs, straight backs, and long, coarse wool. The Southdown, Hampshire, and Shropshire are the better-known medium-wooled breeds. Of these, the Shropshire is the ranking favorite in America. Of the fine-wooled breeds, the Merino is by far the most important. Small in size, with short legs and the skin well bunched about the neck, the Merino is a delicate animal and thrives best in dry climates. The Rambouillet sheep of France is a hardier animal and is fast becoming a favorite in America.

The pelts of new-born lambs of Persian sheep become the fine, valuable astrakhan used for fur coats. The Bighorn, a wild sheep of the Rockies, is described in this work under that title.

Sheep Production.. Australia is far ahead of the rest of the world in sheep raising, although Russia, the United States, India, South Africa, Argentina, New Zealand, and China are also important. About half as many sheep are raised in the United States as in Australia. Most of this number are produced on range lands in the West, the leading states being Texas, Montana, Wyoming, California, and Colorado. The United States produces less than one tenth of the world's wool.

SHEEPS'HEAD. See PORGY.

SHEKEL, *shek''l.* A unit of weight used by the Babylonians and early Hebrews was the shekel. Later, under Simon Maccabaeus, between 141 and 134 B. C., the Jews had coins of different values which were called shekels. This term is now used colloquially to refer to money in a general sense.

SHELL. Certain soft-bodied animals, notably the mollusks (see MOLLUSCA), protect themselves from outside disturbances by the formation of an exterior covering of shell. This is a hard substance formed by the secreting of lime from the body. It grows layer by layer, sometimes all in one piece, as in the *univalve* shells, and sometimes in two parts connected by a hinge, forming a *bivalve* shell. The univalve shells, such as those of the land snail, the chambered nautilus, the conch, and many others, are often very beautiful, but are of less commercial importance than the bivalves, which include shells of oysters, mussels, and clams.

From the pearly inner layer of these shells, such articles as buttons, handles, buckles, and various other ornaments are made (see MOTHER-OF-PEARL). The shell is inlaid with bits of other shell, like that of the abalone, to make jewelry of various kinds, card cases, and opera glasses of rare beauty. In some parts of India and Africa, small cowrie shells are used as currency, and in the Philippine Islands a flat, thin, transparent shell is substituted for window glass.

SHELL. Early in the history of cannon, the shell was used as ammunition, but its service was generally hampered by the absence of fuses. In modern times, shells have been perfected to such an extent that they have superseded the use of shot, and some types are almost invincible as a means of inflicting destruction in time of war.

Official U. S. Navy Photograph

". . . AND PASS THE AMMUNITION"

A shell usually has a cylindrical body with a tapering head and is made of cast or forged steel. In common pointed or high-explosive shells, solid caps of steel are placed over the points. The case of the shell contains the charge, which sends the projectile toward the target. Inside the projectile is gunpowder or other high explosive which causes the shell to burst when it strikes or when detonated by a fuse. The proximity fuse, developed during the Second World War, causes the shell to explode when it is near its target (see FUSE).

Common pointed shells are used for piercing light armor. High-explosive (H.E.) shells have comparatively thin walls and contain amatol, TNT, and picric acid, among other powerful chemicals. They are used for general blasting and are capable of inflicting considerable damage in war. Shrapnel shell, named for its inventor, Lieutenant Henry Shrapnel of Great Britain, also has thin walls, and a fuse usually screwed into the head or socket. The projectile is filled with bullets, which, when the shell explodes, fly in a fan shape. This type of shell has proved effective in modern wars. Armor-piercing shells have specially hardened heads and are fitted with caps to penetrate heavy armor plate. Gas, smoke, incendiary, and star (for illumination) shells are other types in use by modern armies.

POET IN REVOLT

Shelley resented society's restraint, but his poems are full of lyric beauty.

The size and weight of shells vary with the type of guns, the distance they are to be fired, and the purpose for which they are used. See ARTILLERY; CANNON.

SHEL'LEY, PERCY BYSSHE (1792-1822). Like a flaming meteor, the life of the poet Shelley burned fiercely and briefly. He lived only the short span of thirty years; but his delicate, graceful, and melodic poetry will live with the ages. He was one of the leading figures in the English Romantic movement.

Shelley, throughout his life, was in constant revolt against the fetters of social custom. As the scion of an ancient family of Sussex, he was sent to Eton and Oxford, and at both schools he was tormented by his fellow students. At Oxford he achieved a reputation for literary ability, but he was expelled for writing a pamphlet entitled *The Necessity of Atheism.* Following his expulsion, he eloped with Harriet Westbrook, a girl of sixteen, in 1811, but after three years they separated. His wife committed suicide in November, 1816, causing Shelley great sorrow. Shortly afterward, however, he married Mary Godwin.

Shelley's health was not good. Besides, he feared that, because he was an atheist, his children would be taken from him. So in March, 1818, he left England for the continent. While sailing in the Bay of Spezia, Italy, July 8, 1822, he was drowned in a storm. His body was cremated and the ashes placed in the Protestant cemetery in Rome.

In *Queen Mab, The Revolt of Islam,* and *Prometheus Unbound,* Shelley combined the melodic beauty of his verse with his belief in an ideal society in which the development of the individual dominated everything else. Some of his other poems are *The Cloud, Ode to a Skylark, Lines to an Indian Air, Ode to the West Wind, Ode to Liberty,* and *To Night.*

SHELTER. See ARCHITECTURE; BUILDING.

SHENANDO'AH RIVER. Having its source in the mountains not far from Lexington, near the western border of Virginia, the Shenandoah River flows for 200 miles northeastward to Harper's Ferry, W. Va., where it joins the Potomac River. Its beautiful fertile valley, lying between the Blue Ridge Mountains on the east and the Alleghenies on the west, is one of the most productive spots in Eastern United States. Several battles of the Civil War were fought in the Shenandoah Valley.

SHEP'HERD DOG. See COLLIE.

SHER'ATON, THOMAS (1751-1806). Ranking high among designers of fine furniture, Thomas Sheraton developed a distinctive and beautiful style of furniture characterized by simple, graceful lines, sweeping curves, elaborate decoration, and the use of inlay. Sheraton furniture became very popular, and the design is widely used today. Sheraton, born at Stockton-on-Tees, England, first became known in London in 1790, but probably had lived there previously.

DARING CAVALRY LEADER

General Sheridan's raids into Confederate-held territory cleared the way for Grant's army.

His books on furniture, the first of which was published in 1791, soon won a wide following. These books include *The Cabinet-Maker and Upholsterer's Drawing Book, The Cabinet Dictionary,* and *The Cabinet-Maker, Upholsterer and General Artists' Encyclopedia,* each volume being illustrated with his designs. Sheraton was never prosperous and it is doubtful that he owned a shop, but his original designs were used for much furniture probably made under his direction. See FURNITURE.

SHER'IDAN, PHILIP HENRY (1831-1888). A valorous cavalry leader whose dashing attacks won many important Union victories during the Civil War, Philip Henry Sheridan contributed much to the final victory of the North. Sheridan was born in Albany, N. Y., but his parents soon moved to Ohio. He secured an appoint-

"FROM WINCHESTER, TWENTY MILES AWAY!"
Sheridan's famous ride to turn the engagement at Cedar Creek from a rout into a Union victory won him lasting glory.

ment to West Point and was graduated in 1853. When the Civil War broke out, Sheridan was a lieutenant, but was quickly raised to the rank of a captain, and in 1862 was made a colonel in the Second Michigan Cavalry. Shortly afterward he assumed command of the eleventh division of the Army of the Ohio.

In April, 1864, General Grant gave him the command of the cavalry of the Army of the Potomac. He next headed the Army of the Shenandoah, and during the campaign in the valley he is said to have made his famous ride from Winchester to Cedar Creek, which turned a Federal defeat into a smashing victory. The Confederates were driven from the valley and lost their source of food supplies. As the final advance upon Richmond progressed, Sheridan was Grant's chief support, and it was through his leadership at the Battle of Five Forks that Lee was forced to leave Petersburg and Richmond. This retreat was shortly followed by Lee's surrender, on April 9, 1865. In 1869 Sheridan became a lieutenant general, and in 1884 the commanding general of the United States Army. See CIVIL WAR IN AMERICA.

SHERIDAN, RICHARD BRINSLEY BUTLER (1751-1816). A writer of comedies noted for their keen wit and satire, Richard Brinsley Sheridan ranks among the greatest of the eighteenth-century English dramatists. His finest plays are *The School for Scandal* and *The Rivals;* revivals of both have been enjoyed by modern audiences. Other works include *The Duenna,* a comic opera, and the comedies *Saint Patrick's Day* and *The Critic.* Sheridan also gained considerable fame as a statesman and orator during his twelve years in Parliament, and was an important figure in the impeachment proceedings against Warren Hastings.

The author, who was born in Dublin, was a prominent figure in London literary circles because of his ingratiating personality and keen wit. Sheridan's last years were beset with financial difficulties, especially after the burning of his Drury Lane Theater. He is buried in Westminster Abbey.

SHERMAN, ROGER (1721-1793). An early American patriot, Roger Sherman participated in many of the great history-making events of the colonial period. Born in Newton, Mass., in his boyhood Sherman worked as a cobbler with his father. In 1743 he went to New Milford, Conn., was county surveyor for a time, studied law, and was admitted to the bar. Sherman became a member of the Connecticut colonial assembly, a judge of the superior court, and a member of the state senate. He was selected as a member of the committee which drew up the Declaration of Independence and the Articles of Confederation. Sherman was also an important figure in the Constitutional Convention of 1787, and later became one of Connecticut's first Representatives in the new Federal Congress. In 1791 he was elected to the Senate, where he served until his death. For many years he was treasurer of Yale University.

SHERMAN, WILLIAM TECUMSEH (1820-1891). History places William Tecumseh Sherman second only to Grant as the ablest Union general in the Civil War. Born in Lancaster, Ohio, Sherman received his military training at West Point. After serving in the army in Florida and Mexico, he retired to private life in 1853. At the outbreak of the Civil War, he rejoined the army with the rank of colonel. He fought at Bull Run, and Shiloh, and aided Grant at Vicksburg, Memphis, and Chattanooga. In 1864, after ravaging the country near Jackson and Meridian, Miss., he succeeded Grant in command of the Mississippi division and commenced the invasion of Georgia.

He met stalwart resistance from General Joseph E. Johnston until that able general was replaced by General Hood. Sherman captured Atlanta in September, and within two months he was on his way to Savannah. His 60,000 soldiers lived off the country on the historic march to the sea, plundering and destroying as they went. After capturing Savannah, in December, Sherman turned northward, and on April 26, 1865, he received the surrender of General Johnston. As Lee had already surrendered to Grant at Appomattox Court House, the war was ended.

MARCHER TO THE SEA
General Sherman hastened the end of the Civil War by cutting Confederate lines of communication and reducing the South's supply area.

The following year Sherman was appointed lieutenant general, and in 1869 he became commanding general of the United States Army. His *Memoirs,* a valuable document of the Civil War, were published in 1875. See CIVIL WAR IN AMERICA.

SHET'LAND ISLANDS. North of Scotland and the Orkney Islands and directly west of Bergen, Norway, lie the Shetland Islands. There are more than a hundred islands, mostly small, and the total area is about 550 square miles. The islands form a county of Scotland. Only twenty-four of the islands are inhabited; the population is estimated at 19,700. Deeply indented shores with steep cliffs, rugged hills, and small lakes make the islands scenically attractive. The climate is cool and moist.

The largest island is Mainland, comprising nearly seventy-five per cent of the total area. The chief town is Lewick, for many years an important trading center. Yell is the next largest island. Other inhabited islands are Unst, Bressay, Noss, Fetlar, and East and West Burras. The principal industry of the Shetlands is fishing, as the surrounding waters contain plentiful supplies of cod, herring, and ling,

Courtesy Raymond-Whitcomb, Inc.

A SHETLAND ISLAND LAD
This hard-working youngster lives in Lerwick, the center of a large herring-fishing industry.

and some seals and whales are caught. Most of the soil is poor, and the farms average between five and ten acres. The chief farm products are oats, barley, and hay. Cattle, sheep, and horses are raised extensively. The islands are the home of the famous Shetland pony. Fine knitted goods and hand-woven tweeds are also widely known products.

The people of the islands are the descendants of the old Norse vikings. Scientists have been greatly interested in the relics of the Stone Age that are scattered throughout the Shetlands.

SHIELD, *sheeld.* Until firearms rendered it useless, the shield was an important part of every soldier's fighting equipment. Made of wood or metal, it was carried on the left arm as a defense against spears and sword blows.

The shields that were carried into battle by the early Greeks were large, covering nearly the entire body; those of the Roman soldiers were much smaller. The vikings hung their circular shields along the sides of ships when sailing away for adventure. It was the custom in the twelfth century to carry a slain soldier from the field of battle upon his shield. A few centuries later, it became common practice to hang shields in the churches. During the Middle Ages, shields were marked with heraldic devices to enable soldiers to distinguish friend from foe, for both men and horses were completely hidden by armor.

PROTECTION AND IDENTIFICATION
Heraldic devices on the knight's shield gave notice of his identity to friend or foe.

Savage races of Africa still use the shield as a defense against spears and poison darts. These are made from oxhide, specially toughened. Gunners manning modern heavy artillery are partially protected by heavy steel shields which are built around the cannon's barrel.

SHIITES, *she'ites.* Of the two great sects of Mohammedans, the Shiites, centering chiefly in Persia, are of minor importance. They refuse to accept the Sunna, or body of traditions about Mohammed, as the law, and believe that Ali, the fourth caliph after Mohammed, was his first rightful successor. The orthodox Mohammedans are Sunnites. See MOHAMMEDANISM.

SHIL'LING. In the British monetary system, the shilling is one twentieth the value of the pound sterling. A silver coin, the shilling at par value is worth 24.3 cents in American money. The shilling was long used in the American colonies, and the first American coin, the "pine-tree shilling" of Massachusetts, was of that denomination. See PINE-TREE MONEY.

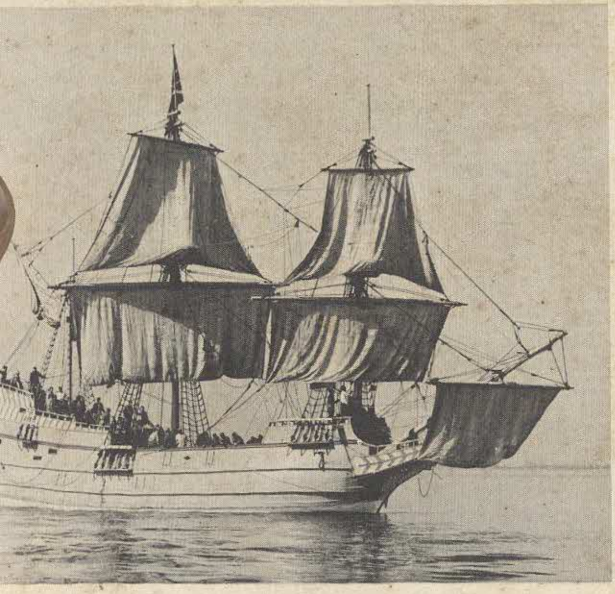
SHILOH, *shi'lo.* Sacred to the ancient Hebrews was the city of Shiloh, where the Ark of the Convenant was kept after the taking of the Promised Land. Eli and his sons were charged with the care of the Ark, and it is said that the unworthiness of the sons was responsible for its loss. After the Ark was taken from Shiloh, the city declined, and today only a number of rock tombs and a pool mark the ancient city. Seilun is the modern name of the place. See BIBLE STORIES.

SHINTOISM, *shin' toh iz'm.* Once the sole religion of Japan, Shintoism was for more than half a century actually an intense expression of the patriotism of the Japanese people instead of a practice of religious faith.

Originally, Shintoism was derived from nature worship, and nearly everything that excited the wonder of the individual was worshiped. It embraced the worship of a number of gods, chief of whom was the Sun Goddess; from her the emperor of Japan was said to be descended.

Buddhism began to replace and modify Shintoism in the sixth century. Attempts were made to restore Shintoism as a pure religion in the nineteenth century, but the only effect was to establish Shintoism as a state institution by a decree enacted in 1884.

On January 1, 1946, state Shintoism was abolished, in accordance with the Allied program to establish freedom of religion in occupied Japan.



OUT OF VIRGINIA'S PAST

The "Susan Constant II," replica of her namesake that landed at Jamestown, Va., in 1607, proved so seaworthy on its maiden voyage that members of the crew were astounded. The 100-ton "Susan Constant II" and two smaller ships were built in conjunction with the 350th anniversary celebration of the founding of Jamestown colony, the first permanent English settlement in America. Squat and broad-beamed, the slow-sailing vessels of the early seventeenth century were usually fitted with two masts. The larger, three-masted ships of commerce did not appear until more than a century later.

UPI

SHIP. The era of steamships began with Robert Fulton's "Clermont" in 1807, but it was many years before steam displaced sails. In 1819 the "Savannah" crossed the Atlantic, using both steam and sail, a method employed for years. Sails finally were discarded with the introduction of the screw propeller. The era of modern ships began when steel hulls replaced iron hulls in the late 1800's.

Ships of the 1880's ranged between 10,000 and 20,000 tons, and steamships of 25,000 to 35,000 tons were considered large up to the time of World War I. Just before the war broke out, Germany built two great ships—the "Bismarck," which was 915 feet long and had a tonnage of 56,621, and the "Vaterland," which was 907 feet in length and had a tonnage of 59,957 (later reduced to

Weyerhaeuser Co.

WHEN SAILS RULED THE SEAS

America's early entry into world commerce was launched in ships built of wood. Perhaps no other ship in American history was so symbolic of America's place on the high seas as the 44-gun frigate, the "Constitution," below, built in 1797. Later called "Old Ironsides," it was well named. Its ribs and siding were of heavy oak, and its deck planking of red cedar. The ship served for more than thirty years through the Tripolitan War and the War of 1812. Ordered dismantled in 1830, it was rebuilt in 1833 and again in 1877 at the insistence of an aroused public. The ship is still preserved as a memorial at the Boston Navy Yard.

John Hancock Mutual Life Insurance Co.

48,943). The British captured the *Bismarck* and renamed her the *Majestic;* the United States confiscated the *Vaterland* in New York Harbor and renamed her the *Leviathan*.

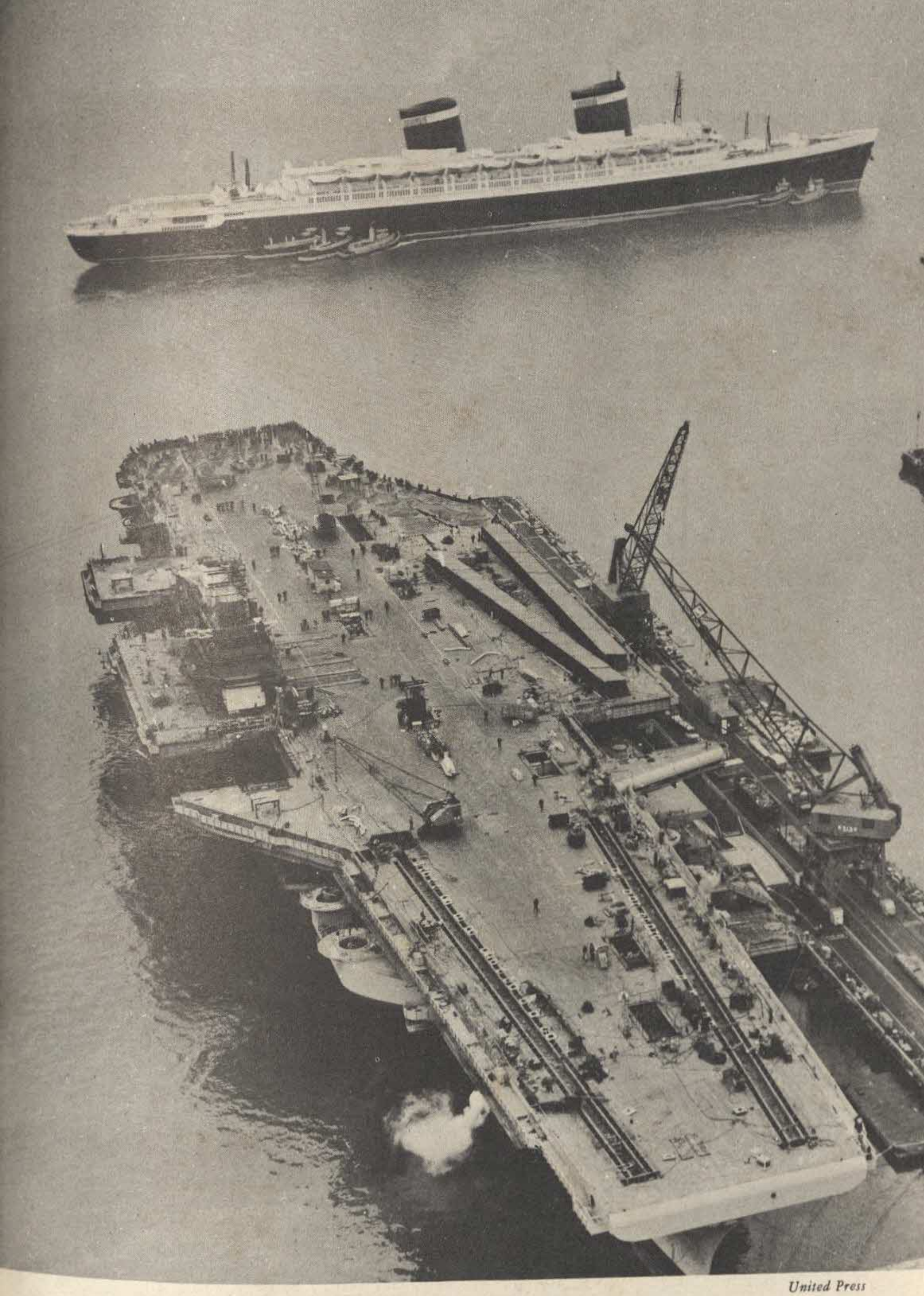
The *Leviathan* served as an American transport ship during World War I, and after the war was recommissioned as a luxury liner. Until 1930 the *Majestic* and the *Leviathan* were the world's largest ships, but the race for speed and luxury brought larger and faster vessels into service. The *Leviathan* was finally sold for scrap in 1937, after lying idle for several years.

BRAVE SHIPS OF SAILING DAYS
Right, this three-masted, full-rigged ship has sailed the seven seas for more than fifty years. Below, a junk sailing along the coast of China.

Acme

The original *Mauretania,* which was scrapped in 1935, for many years held the speed record for Atlantic crossings; but she lost out in the race for prestige and speed which began in 1930. Italy began the race by building the *Rex,* a ship of 51,062 tons and 880 feet long, and the *Conte di Savoia,* of 48,502 tons and 814 feet long. Then Germany entered the competition with the *Bremen,* 51,733 tons, and the *Europa,* 49,746 tons, both of which broke all speed records on the Atlantic. France built the *Ile de France,* 43,450 tons, in 1931, and followed it four years later with the great *Normandie,* 83,423 tons. This vessel was rivaled by the *Queen Mary,* 81,235 tons, which was launched by England in 1936.

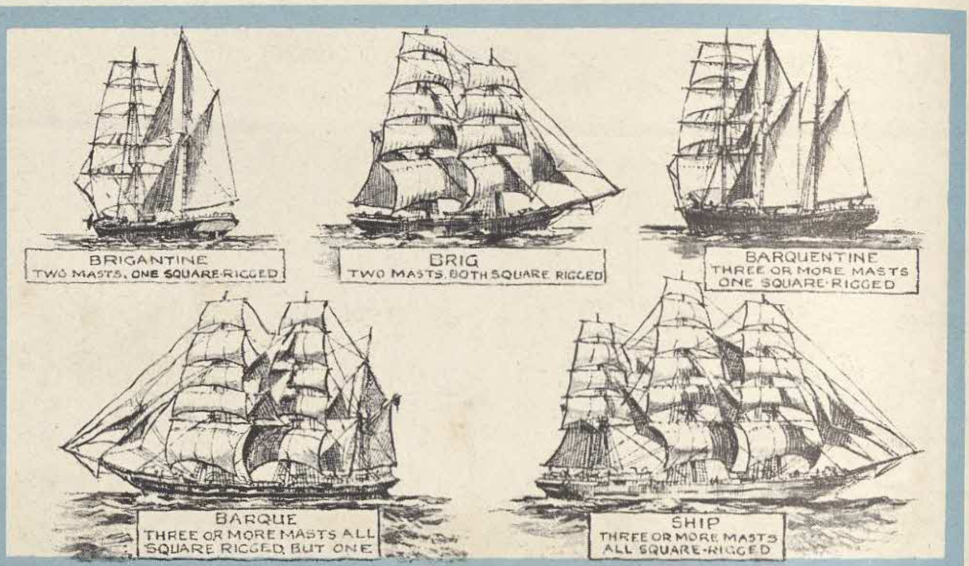
When war began in 1939, these two liners were tied up in New York Harbor, where they were joined early in 1940 by the largest liner ever built, England's *Queen Elizabeth*. The 85,000-ton vessel was rushed to completion during the early months of the war; and it slipped across the Atlantic

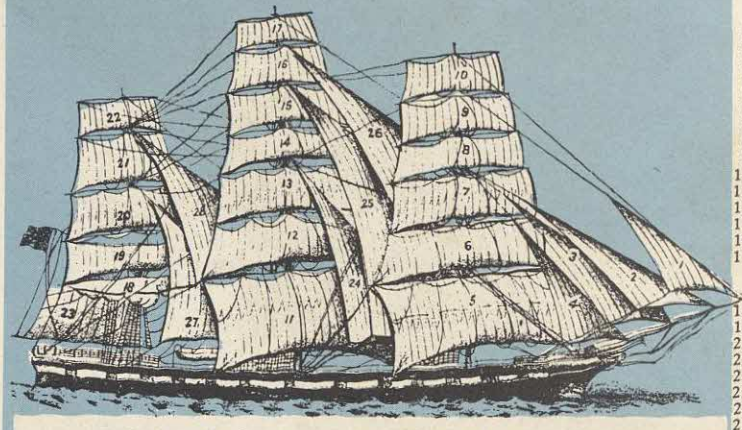


United Press

AMONG THE WORLD'S LARGEST SHIPS

A great luxury liner is moved to drydock for her yearly overhaul, while finishing touches are added to the super-sized aircraft carrier in the foreground.





THE SAILS OF A SHIP

1. Flying jib
2. Outer jib
3. Inner jib
4. Fore topmast staysail
5. Foresail, or fore course
6. Lower fore topsail
7. Upper fore topsail
8. Lower fore topgallant sail
9. Upper fore topgallant sail
10. Fore royal
11. Mainsail, or main course
12. Lower main topsail
13. Upper main topsail
14. Lower main topgallant sail
15. Upper main topgallant sail
16. Main royal
17. Main skysail
18. Crossjack (brailed up)
19. Lower mizzen topsail
20. Upper mizzen topsail
21. Mizzen topgallant sail
22. Mizzen royal
23. Spanker or driver
24. Main topmast staysail
25. Main topgallant staysail
26. Main royal staysail
27. Mizzen topmast staysail
28. Mizzen topgallant staysail

SOME TYPES OF SHIPS AND THEIR SAILS
Sailing ships are classified by the rigging; all may look alike to the "landlubber" but not to the seaman's practiced eye.

to safety. The *Queen Mary, Queen Elizabeth,* and a new *Mauretania* were in transport service during World War II. The *Normandie* burned in 1942.

For additional information, consult the following articles:

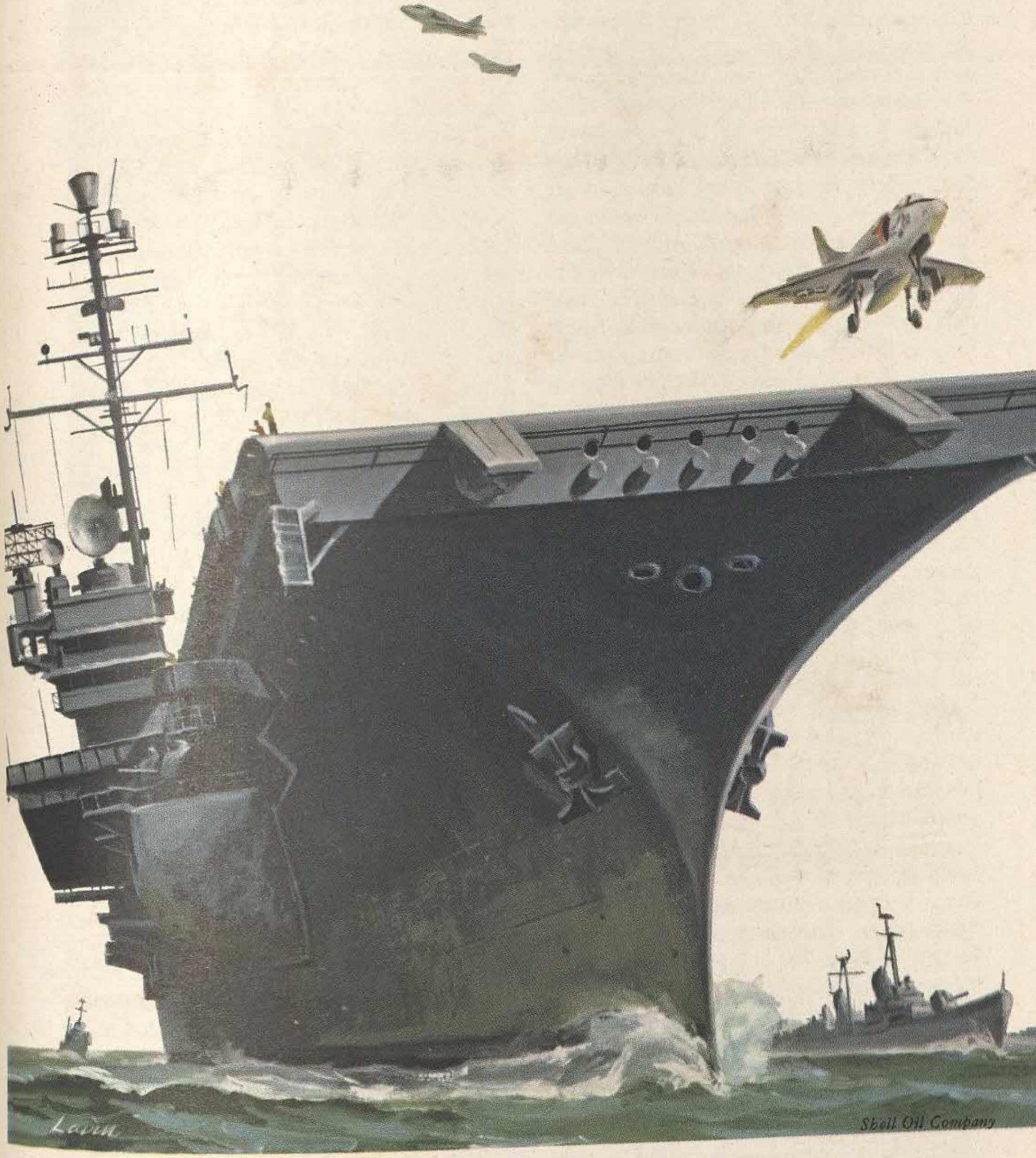
Boat	Monitor and Merrimac
Fitch, John	Navigation
Fulton, Robert	Sailboat and Sailing

SHOES. See BOOTS AND SHOES.

SHOOTING STAR. See METEOR.

SHORE. The land bordering a large body of water is spoken of as the shore. Upon the character of the shore depends much of the commercial progress of a country. A shore that has been developed mainly through uplift will have a few harbors. Such is the case in Southern United States. On the other hand, a submerged coast usually affords an abundance of harbors. New England has such a coast, and New York Harbor, Chesapeake Bay, and Delaware Bay are all examples of harbors made by the drowning of river mouths.

It is thought that glaciers coming down to the sea and scouring out valleys are re-



THE MODERN CARRIER IS A FAST-MOVING AIRFIELD

Bristling with armaments, driven by high-speed turbines, the aircraft carrier is no longer the vulnerable ship it was twenty years ago. The largest warships afloat are the attack carriers, with a displacement of more than 60,000 tons and a complement of over 4,000 officers and men. Such ships are home base for scores of jet fighters and a large number of long-range jet bombers carrying atomic bombs. Even larger are some of the nuclear-powered carriers, which have almost unlimited cruising range and larger hangar and storage areas replacing the fuel tanks.

sponsible, partly at least, for deep fiords or bays in certain coast regions, as in Chile, Alaska, and Norway. Some shores are characterized by bars and spits deposited by waves and long shore currents. A spit is a sandy deposit which does not reach entirely across a bay or other enclosure. Erie, Penna., is a lake-shore harbor, and Sandy Hook, N. J., an ocean harbor, owing protection to such a deposit. When a spit has been enlarged to reach entirely across the indentation, it becomes a bar. The city of Galveston is built on such a bar. These deposits illustrate the tendency of shore lines to become regular by cutting off the indentations, because behind these bars the lagoons are soon filled in.

SHORT'HAND. Anyone who has tried to take full notes of the words of a lecturer or other public speaker knows how far from possible it is to write as fast as someone else can talk. But a person trained in stenography, or shorthand writing, can record every word that is said, even by one who speaks with more than usual rapidity. Shorthand is one of the greatest assets of the modern commercial world.

Boys and girls who have studied the Latin orations of Cicero will be interested to know that Cicero's secretary was the first inventor of a system of shorthand. This system survived as long as the Latin language. It is said that Saint Jerome had an establishment of ten stenographers. Modern shorthand is much superior to the ancient system. There have been many varieties of it, some 200 having been recorded before the invention by Isaac Pitman, in 1837, of the first of the systems now in general use. All of these systems are based on the idea of having a symbol for each sound instead of merely one for each letter of the alphabet. Thus, *might* and *mite* would be written alike, usually with a single stroke of the pencil. There are many such shorthand symbols. Shorthand-writing machines like the Stenotype enable operators to produce perfectly legible notes at very high speed. Unlike hand-written notes, these can be read by any stenographer.

SHOSHO'NEAN INDIANS. No family of Indians contained more savage tribes than the Shoshoneans, who inhabited the region west of Kansas from Texas and New Mexico to Southern Montana, and west to the Pacific coast. Savagery was particularly characteristic of the hunting tribes, such as the Comanche, who lived east of the Rockies. The Hopis of Arizona, however, were a peaceful group. The Shoshonean tribes spoke a similar tongue, and this was the closest tie among them, for physical bonds were not very evident. Among this family of Indians was the Shoshoni tribe, also known as the *Digger,* or *Snake,* Indians. They were among the most primitive of Indian tribes.

For additional information, consult the following articles:

Comanche
Hopi
Indians, American
Ute

SHOT. Practically all small-game hunting today is done with shotguns, which fire tiny lead or steel pellets known as shot. Lead shot is made by pouring molten metal from a considerable height into cold water. The lead assumes a spherical form while falling and hardens upon striking the water. Small shot is made for hunting such birds as quail and grouse; for larger game such as rabbits and squirrels, a heavier shot is necessary. The sizes are designated by number.

SHOT, Putting The. In putting the shot, the athlete stands far back in a seven-foot circle, with his left foot forward (if he is right-handed) and with the shot held loosely in his right hand, which rests upon his right shoulder. The shot is a metal ball weighing twelve or sixteen pounds, the lighter sphere being used by high-school athletes. The weight of the body rests almost entirely upon the rear (right) leg. Swinging the left leg several times for balance, the athlete hops on his right leg to the center of the circle, touching the ground lightly with the free foot. The shot is then vigorously pushed outward and slightly upward with the right hand, the left swinging to the rear to add momentum. Just as

Courtesy The Athletic Journal

IN PERFECT FORM

A champion of collegiate competition demonstrates conventional form in putting the shot.

the shot leaves the hand, it is given a final flip with the fingers.

With the follow-through, the position of the feet is reversed, the body leaning well out over the circle. The movement across the circle is practically continuous, being more like a glide than a hop. Putting the shot involves getting the weight of the body behind the shot, rather than relying on the strength of the arm to furnish the power. See ATHLETICS.

SHOT'GUN. The weapon of small-game hunters is the shotgun, a smooth-bore gun which discharges a quantity of small pellets (shot) when fired. On account of the number of shot used, and their scattering over a considerable area, the shotgun is employed for killing game on the wing. The size of bore of a shotgun is designated by the gauge, which varies from sixteen to ten in ordinary guns. The gauge is determined by an ancient scale of sizes based on the size of the spherical lead ball required to fill the bore. In order to confine the shot to a smaller area, the bore of the shotgun may be *choked,* or made smaller at the muzzle than at the breech, or loading end.

Shotguns are now made breech-loading with shells which contain the charge of powder and shot. These shells may be changed by hand; or by means of a lever or the sliding action of a mechanism which brings the shell from the magazine and places it in the breech of the gun; or automatically, as in shotguns which discharge the empty shell and reload and recock by recoil action.

SHOVELER, *shuv'el ur,* **or SPOON'-BILL.** Distinctive and colorful is the shoveler, a small fresh-water duck which gets its name from its broad, flat, shovel-shaped or spoon-shaped bill. The shoveler scoops up its food from shallow, muddy water, straining it through tiny comblike projections along the edges of the bill. The male of the species is gaily colored, the female more modest in appearance. The various species are widely scattered throughout all continents.

SHRAP'NEL. Used against troops in open areas and for clearing obstructed spaces, shrapnel is a highly effective shell designed for destruction over a large area rather than for penetration in a confined zone. Shrapnel consists of a metal case, filled with nitrocellulose; and a projectile, loaded with black powder and numerous heavy lead pellets. Shrapnel may be timed to explode by percussion or in the air. When the shell explodes, it throws the balls forward in a fan-shaped spray of death-dealing metal. See SHELL.

SHREW, *shroo.* Some of the smallest North American mammals belong to the shrew family. In form of body and soft, velvety fur, the shrews closely resemble the moles, but they are more slender and more active than moles, being much like small mice in these respects. Shrews are further distinguished from moles by having tiny front feet instead of powerful flattened ones. The nose is much longer, more slender, and more flexible than in the mice, and the mouth opens well back under the snout, being armed with a set of fine, sharp teeth quite unlike those of mice.

Shrews are secretive creatures. They commonly frequent moist places along marshes and streams and burrow about in the moist earth beneath the leafy carpet in forests and underneath fallen logs.

The shrew's long, flexible snout is highly sensitive to the touch, the nose keen of smell. Shrews live largely on insects, earthworms, and other soft-bodied creatures which they are constantly seeking. They even attack mice and young birds, and feed on meat left by other animals or birds of prey. Shrews also eat a wide variety of vegetation. Its bite, although not serious, is slightly poisonous. From man's point of view, shrews are more beneficial than destructive. They should not be killed, for their diet includes many garden pests.

SHRIKE. North America has two species of shrike, a bird having the peculiar habit of hanging its prey—insects and small animals—on thorns, fence barbs, nails, or other sharp points. Shrikes seem to do this for the pleasure of killing, since they rarely return to feed on their prey.

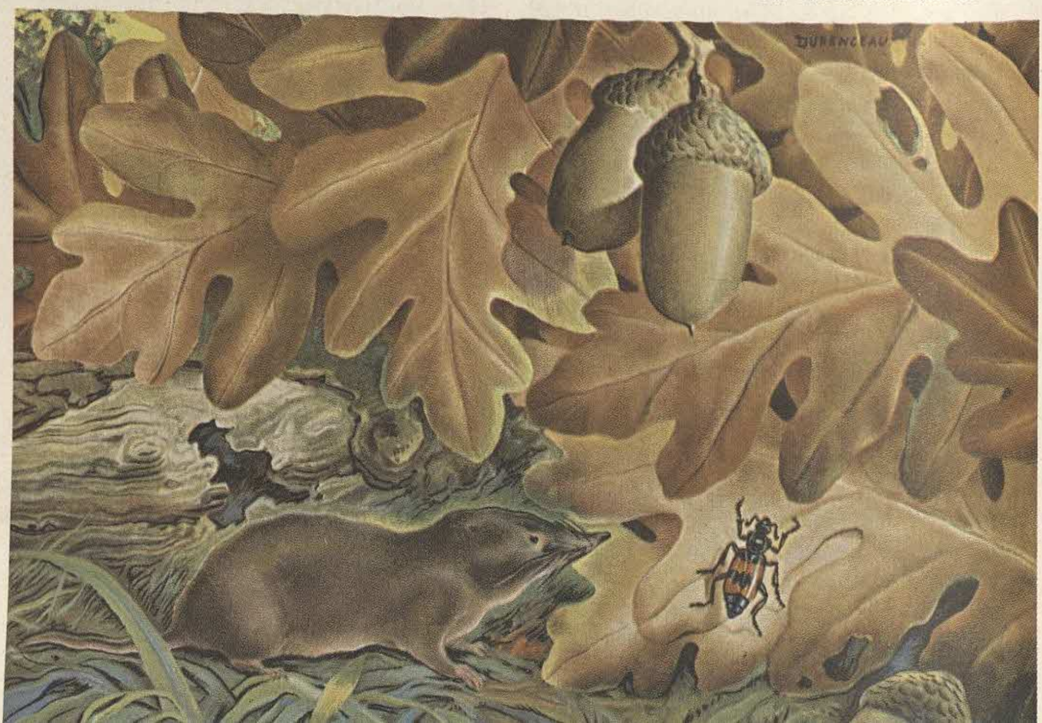
The *northern shrike,* or *butcher bird,* nests in most of Canada and Alaska, but ranges as far south as the Ohio River during winter. It is about ten inches long, gray and white in color, with black wings and tail and a black mark through the eye. The bill, strong and hooked at the tip, is used to strike the prey. The shrike's feet are like those of other perching birds. The shrike feeds on insects and mice, and sometimes on smaller birds, but on the whole does more good than harm. The *loggerhead shrike* is a smaller and more southern species.

While not uncommon, shrikes are not very abundant. Their population does not seem to increase much, although they are usually successful in raising their young. From four to eight grayish white eggs are laid in a nest built a few feet above the ground. Shrikes are often open to attack by hawks and other large birds because of their bold hunting habits. The notes of shrikes are loud and harsh, but occasionally in the

THE SHREW'S APPETITE NEVER LETS IT REST

Throughout the year, the shrew is driven by hunger. It eats about three fourths of its weight in food every day. It cannot hibernate, for even a few meals missed mean death.

The Travelers Insurance Co.



MILK DELIVERY IN SIBERIA'S "ICEBOX"

Winters are extremely cold in Yakutsk. John Ledyard, early American explorer in Siberia, found that the Yakut milkman delivered milk in frozen blocks which kept until needed.

The Travelers Insurance Co.

spring both American species sing songs somewhat like that of the catbird.

SHRIMP. Most of the seafood sold in cans as "shrimps" actually are prawns, which are closely related crustaceans. Prawns are flattened as though they had been slightly pressed from the sides, while shrimps appear flattened as though pressed from the top.

Shrimps and prawns are small crustaceans that feed on decaying matter or on living animals on the ocean bottom. Because of their many enemies, they do most of their feeding at night. During the day they remain hidden under refuse on the ocean floor.

A female shrimp may lay nearly a million eggs at spawning time. The eggs drop to the bottom, where they usually hatch in the warm sea water in about a day. The young go through a number of stages before reaching maturity several months later.

Most shrimps are found in the ocean, although a few species live in fresh water. The Great Lakes and the Ohio and Mississippi rivers produce some types of edible shrimps.

SHROVE TUESDAY. The day before the beginning of the Lenten season in the Roman Catholic Church is Shrove Tuesday. It is so called because confession is made and absolution received in preparation for the observances of Ash Wednesday. Because Lent is a period of restriction, Shrove Tuesday has become an occasion for festivities. It is the day of the spectacular street pageant, the *Mardi Gras,* in New Orleans, and the *Carnival* in Italy. In England it is called *Pancake Tuesday,* because of the custom of eating pancakes on that day.

SIAM. See THAILAND.

SIBERIA. Across northern Asia, from the Urals to the Bering Strait, lies Siberia. In the days of the czars, it was a bleak and forbidding region to which criminals and political prisoners were exiled. The Soviets steadily developed it, and what was once a trackless waste is now dotted with new industrial cities, crossed by irrigation canals and railroads, and cultivated as immense collective farms. In 1922, the Soviet government incorporated the entire region in the Russian Soviet Federal Socialist Republic (R.S.F.S.R.), and the name Siberia was dropped as a political designation.

Location and Size. Siberia forms nearly two-thirds of the R.S.F.S.R., Soviet Rus-

COMMUNITIES RISE FROM THE BARREN WASTES

Once Siberia was a desolate area to which prisoners were banished for punishment. Today it has bustling cities of large population and modern housing projects for workers.

Sovfoto

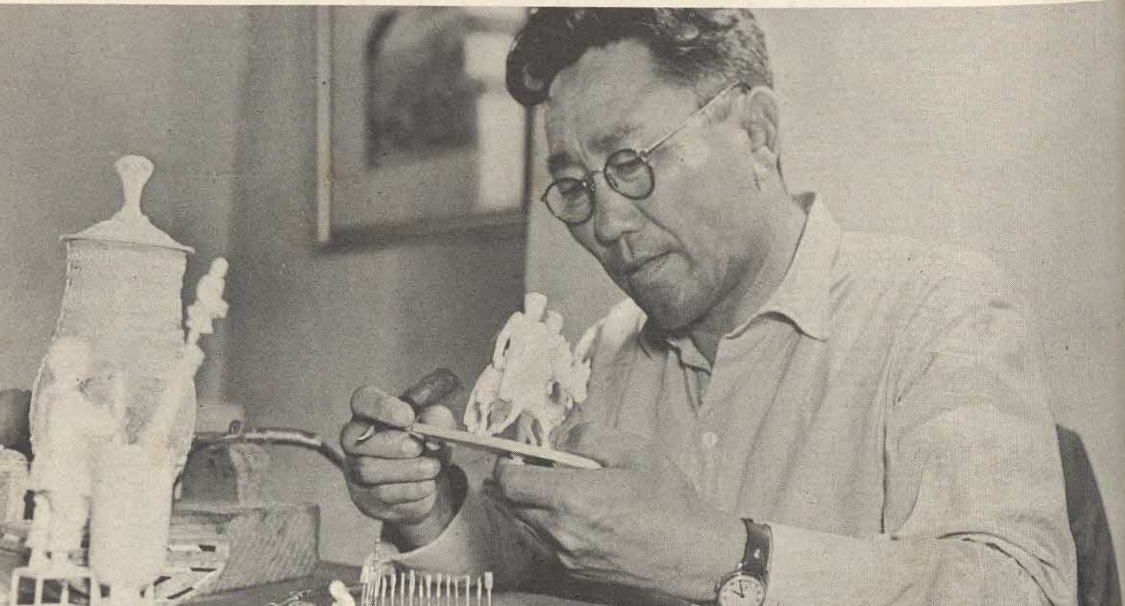
sia's largest Republic. Its long northern boundary is the Arctic Ocean. The Ural Mountains separate it from European Russia on the west, and Bering Strait and the Sea of Okhotsk wash its eastern shores. Soviet Central Asia and the Mongolian People's Republic border it on the south. Its area is about 5,000,000 square miles. Vladivostok is the great eastern port of Siberia, and the eastern terminus of the Trans-Siberian Railway. Other important cities, also on the Trans-Siberian Railway, are Omsk and Irkutsk.

Surface and Climate. The great plain that is Siberia may be divided into four regions. To the north is the *tundra,* frozen treeless marshlands; below the tundra is the forest region, or *taiga;* farther south are the *steppes,* which are a continuation of the black-earth region of European Russia; the southernmost section is semi-desert.

Siberia is a land of short, warm summers and long, cold winters. The coldest place in the world is near Verkhoyansk, in eastern Siberia, where the temperature has been as low as 89.7° F. below zero. In the summer it has been as hot there as 90° F. No other spot in the world has such a wide range of temperatures. See UNION OF SOVIET SOCIALIST REPUBLICS.

SIBERIA'S DELICATELY CARVED IVORY ART OBJECTS

Sovfoto



SIBERIA—A VAST AREA INHABITED BY VARIED PEOPLES

Left, a Mongolian strain is reflected in the features of a Khakass girl of Krasnoyarsk Territory, southern Siberia. Dark-skinned Mongolian types, right, predominate in the Lake Baikal region.

Sovfoto *Burton Holmes from Ewing Galloway*

SICILIES, *sis' il iz,* KINGDOM OF THE Two. Coming into existence in 1130 following a conquest that extended over a period of almost 100 years, the Kingdom of the Two Sicilies consisted of the island of Sicily together with Naples, or Southern Italy. A part of this area passed into the hands of Robert and Roger de Hauteville following a war between the Saracens and Greeks over the same territory in the middle of the eleventh century. The son of Roger, who was known as Roger II, completed the conquest in 1130 and combined the lands into the Kingdom of the Two Sicilies.

At Roger's death, the kingdom was usurped by Emperor Henry VI of the House of Hohenstaufen, who based his claim on the fact that his wife was the daughter of Roger. The Hohenstaufens ruled until 1266, when Pope Urban IV passed the kingdom to Charles of Anjou, brother of Louis IX of France.

Sixteen years later, Sicily shook off the French rule with the aid of King Pedro III of Aragon and became subject to Aragon. Meanwhile, Naples remained with the House of Anjou. It, too, fell into the hands of Arăgon in 1442. The two were reunited in 1504 by the Aragon kings, but divided again by the Peace of Utrecht in 1713, Naples going to Austria, and Sicily to Savoy. Spain reconquered Sicily but lost it immediately to Austria, Savoy receiving Sardinia in the exchange. The entire kingdom was reconquered by Don Carlos in 1734 and remained in Spanish hands until 1860, with the exception of a few years during the Napoleonic period.

The Spanish rule proved so cruel and despotic that revolutions broke out in 1860. Assisted by Italian troops under Garibaldi, the Sicilians defeated their oppressors, driving Francis II from Naples. Soon the kingdom became a part of the Kingdom of Italy. See GARIBALDI, GIUSEPPE; ITALY.

SICILY, *sis' il ih.* Just off the "toe" of Italy, across the Strait of Messina, lies the mountainous island of Sicily. With an area of 9,926 square miles, it is the largest island in the Mediterranean Sea. Its jagged north and east coasts provide a number of fine harbors, chief among them being Palermo, Messina, and Catania. The population of Sicily is about 4,000,000. Mount Etna (10,741 feet) on the eastern coast is one of Europe's few active volcanoes. The climate, except for the periodic *sirocco,* a hot, dry, desert wind, is delightful. The soil is rich and fertile.

An Industrious Island. In spite of the mountainous character of the island, agriculture flourishes. Covering the lower mountain slopes are orange and olive orchards and extensive vineyards. The plateau areas are devoted almost entirely to the cultivation of wheat, oats, and barley. Considerable sugar cane, tobacco, and cotton are also raised. Fishing, too, is an important occupation, tuna, sardines, coral, and

From one of a series of oil paintings, "A History of Pharmacy in Pictures," commissioned by and copyrighted by Parke, Davis & Co.; reproduced by special permission. George A. Bender, project director; Robert A. Thom, artist.

WHEN SICILY WAS CROSSROADS OF WORLD

Frederick II of Hohenstaufen (1194-1250), was king of Sicily, Holy Roman Emperor, and king of Jerusalem. His court at Palermo was a meeting place for scholars from the East and West.

sponges being the leading marine products.

Sicily is one of the world's important sources of sulphur. Rock salt and asphalt are other minerals, but mining is a poorly developed industry. Little manufacturing is carried on, the making of wine, olive oil, and citric acid and the canning of fruits being of most importance. Fruits, wine, olive oil, sumac (for tanning and dyeing), sardines, and sulphur are exported.

For years, neither life nor property was safe in Sicily, because of the dreaded secret society, the Mafia. When Mussolini came to power, however, he practically eliminated such lawlessness by bringing hundreds of the society's leaders to trial.

History. The original inhabitants of Sicily were the Sicani, who were later dominated by the Phoenicians. In the eighth century B.C., came the Greeks, spreading their culture over the island and driving off the Carthaginians in 480 B.C. After Rome defeated the Carthaginians in 241 B.C., Sicily became a Roman province. In the sixth century A.D., the Goths swept over the island but were soon driven out; Sicily then became a part of the Byzantine Empire. Later the Saracens gained control, and were in turn displaced by the Normans in the eleventh century. Since 1860, Sicily has been a part of Italy. In 1943, during World War II, Allied forces invaded and conquered Sicily and used the island as a springboard for the invasion of Italy.

SID'NEY, Philip, Sir (1554-1586). Although he achieved great fame for his literary works, including his incomparable prose romance *Arcadia,* his *Apologie for Poetrie,* and the *Astrophel and Stella* sonnets, Sir Philip is best remembered in history as the perfect type of Elizabethan gentleman and courtier. He was a great favorite of Queen Elizabeth, who knighted him in 1583. After graduating from Oxford, Sidney traveled extensively through Europe. Following his return to England, he served his country on innumerable diplomatic missions in Europe. At one time he planned an expedition with Sir Francis Drake to the West Indies, but Elizabeth refused to permit him to leave. Sidney later won military distinction in the Netherlands, where the English were aiding the Dutch in their struggle against the Spanish. He was fatally wounded in the Battle of Zutphen.

SI'DON. One of the leading cities of ancient Phoenicia, this Mediterranean seaport was noted for its wealth, trade, and manufactures. Supposedly glass was first made there. Modern Saida, in Lebanon, occupies part of the site of Sidon. See Phoenicia; Tyre.

SIEGFRIED, *seeg' freed.* See Sigurd.

SIER'RA LEONE, *le ohn'.* A British colony along Africa's west coast and an adjoining hilly protectorate, Sierra Leone covers 27,925 square miles and has some 2,500,000 people, mostly Negroes. Very hot and wet, it is largely undeveloped. Nuts and palm oil are major exports. Freetown, the capital, was founded in 1788, chiefly by freed Negro slaves.

SIERRA MADRE. See Mexico.

SIERRA NEVADA, *ne vad' uh.* For about 450 miles through the eastern part of California stride the massive Sierra Nevada, an almost continuous range of mountains containing many lofty peaks. They extend in a northwesterly direction from Tehachapi Pass on the south to Oregon on the north.

The highest peak in this mountain chain is Mount Whitney (14,495 feet), located in Sequoia National Park. Other lofty peaks are Mount Williamson (14,384), Mount Corcoran (14,042), and Mount Shasta (14,161). Several other peaks tower more than 13,000 feet above sea level.

Throughout the Sierra Nevada are numerous valleys, sharply isolated by perpendicular walls, creating scenic marvels. One of the beauty spots of the range is Yosemite Valley. Best known among the scattered passes of the Sierra Nevada are: Truckee Pass, through which runs the Southern Pacific Railroad at an altitude of more than 7,000 feet; San Joaquin Pass, centrally located; and the Tehachapi Pass in the south.

This lofty range has caused a vast desert to the east, the rain-laden clouds from the Pacific dropping almost all their moisture on the western slopes.

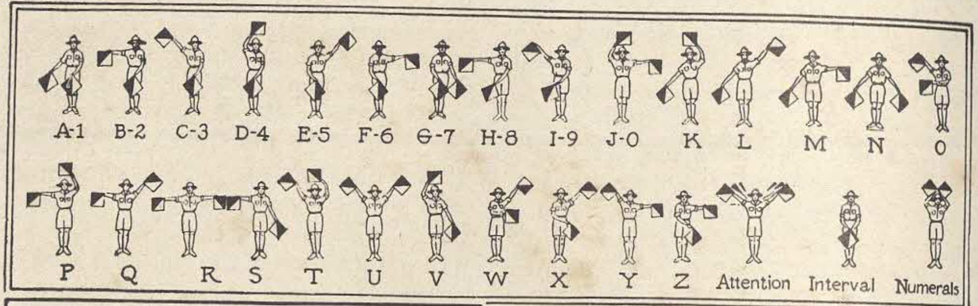
SIG'NAL CORPS, *kore.* Army movements in modern wars are on such a large scale that a system of communication must be maintained to inform all commanders of maneuvers and objectives. The task of gathering information and transmitting it for these operations is in the hands of the Signal Corps, a separate branch of the army.

Members of the Signal Corps must be familiar with all forms of communication, and must be able to interpret all kinds of codes. The corps is usually equipped with the telephone and telegraph, radio, flags, lights, flares, the heliograph, radar, and even homing pigeons. It also takes photographs for training and historical purposes. The service of the Signal Corps was noteworthy in World Wars I and II.

In the United States the Signal Corps dates from the appointment of Major Albert J. Myer as chief signal officer in 1860. For a time the corps was charged with making weather observations and forecasts, a task since taken over by the Weather Bureau, in the Department of Commerce.

For additional information, consult the following articles:

Army
Flag
Heliograph
Navy
Radar
Signaling
Telegraph, Wireless
Weather Bureau



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G	— — ·	T	—	7	— — · · ·
H	· · · ·	U	· · —	8	— — — · ·
I	· ·	V	· · · —	9	— — — — ·
J	· — — —	W	· — —	0	— — — — —
K	— · —	X	— · · —		
L	· — · ·	Y	— · — —		
M	— —	Z	— — · ·		

TALKING WITH SIGHT AND SOUND

One of the oldest of man's arts, signaling is today even more important than it was in prehistoric times. Top, the flag semaphore-signaling system of the Boy Scouts. Below, the dot-dash system known as the International Code.

SIGNALING. Three dots—three dashes—three dots. Many times this dreaded signal has flashed from the wireless room of a disabled ship in the hope that aid would come soon. For this signal, known the world over, is SOS, the distress call of navigation.

The SOS is only one of the many signals used by ships, armies, telegraph companies, and railroads to communicate with other ships, army posts, branch stations, and depots. Famous dot-dash systems are the Morse Code, named for its inventor, Samuel F. B. Morse, and the International Code. Not only over wires or through the ether is the dot-dash system used. Signals can be sent by flags, heliograph, lanterns, and torches. The flag and heliograph methods are useful only in the daytime; the other two can be used only at night.

Dots are signaled by flag, when the flag is brought downward to the left in a ninety-degree arc. The dash is signaled by a similar movement to the right. Pauses are signaled by bringing the flag to the feet. Flashlight signals are made with a shutter, long flashes being dashes, and short ones representing dots. This system is also used in the case of a heliograph. Smoke signals can be sent by building up a smudge fire and using a blanket to cover the smoke between the dots and dashes.

Another method, in addition to the dot-dash system, is the two-arm semaphore. The signaler uses two identical square flags, divided diagonally in two colors. In addition to wireless, boats also use a system of twenty-six flags for signals, each representing a letter. Horns, bugles, whistles, drums, and other sound instruments also can be used for signaling.

For additional information, consult the following titles:

Flag	Semaphore
Heliograph	Signal Corps
Radio	Telegraph

SIGN LANGUAGE. American Indian tribes, even though they spoke different languages, were able to converse with each other by sign language. Apparently this wordless means of communication came naturally, for Indians of far-removed tribes had little difficulty in making those of another region understand. They had such signs as two fingers extended vertically at the side of the head to signify *wolf;* drawing a finger across the forehead to mean *white man,* indicating the white man's cap or hat; and the motion of breaking a stick to represent *strength.*

Those who are deaf and dumb also use a sign language, but it is based on the letters of the alphabet, rather than on ideas. Originally, however, it resembled the Indian sign language. See ALPHABET; DEAF AND DUMB; SIGNALING.

THE TWILIGHT OF THE GODS
This scene from the opera by Richard Wagner depicts Sigurd's last journey as his body is carried toward the Hall of the Gibichungs after his murder. Following the bearers is Gunther.

SIGURD, *se′gurd.* Throughout the northern countries of Europe, stories are told of Sigurd, or Siegfried, the great hero of the Nibelung legends. According to one tale, Sigurd slew the dragon Fafnir with the sword which had been given to his father, Sigmund, by the god Odin. Sigurd ate the heart of the monster and found that he could understand the language of the birds. Thus he learned of Brunhilde, one of the Valkyries, who had been put to sleep by Odin until some hero should penetrate the flames that surrounded her. This Sigurd did; and, falling in love with Brunhilde, he determined to claim her when he returned from his trip to the land of the Nibelungs.

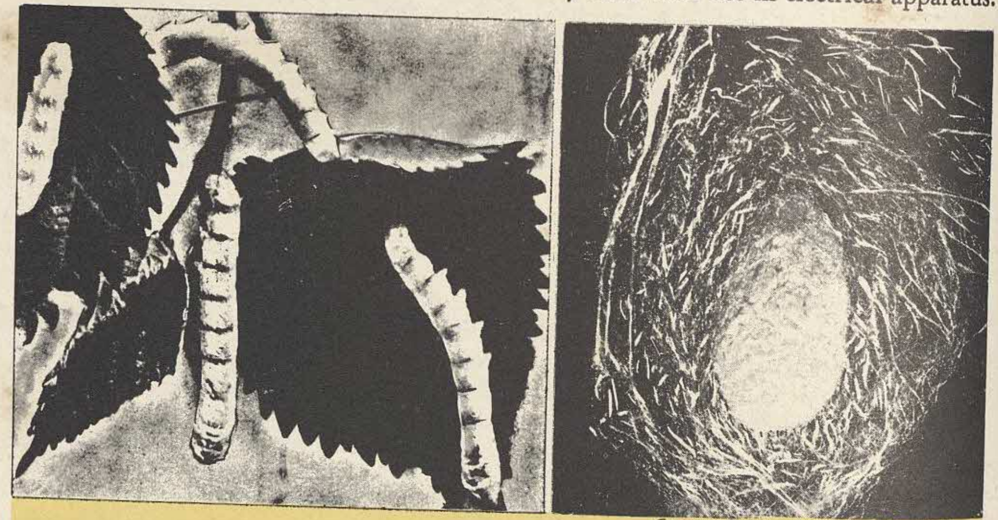
But when he visited the Nibelungs, the wife of their king made him drink a potion which caused him to forget his love. Instead, he married Gudrun, the princess. Gunther, Gudrun's brother, then fell in love with Brunhilde; and Sigurd, assuming his form, won the Valkyrie for him. But despite the potion, Sigurd recognized Brunhilde, and she, still in love with him but forced to punish him, had him killed. Then she threw herself on his funeral pyre and died.

SIKHS, *seeks.* The Sikhs, whose name means *disciples,* are a religious sect founded in the Punjab of India in the 1400's. Nanak, whose teachings embraced precepts from Mohammedanism, Hinduism, and Buddhism, founded the sect, which increased rapidly in numbers. The Sikhs began to grow in power in the seventeenth century, and early in the nineteenth they conquered the Punjab and Kashmir.

After the death of Ranjit Singh, who ruled the Sikhs from 1792 to 1839, a period of anarchy ensued, and in 1845 the Sikhs challenged British domination of India in the First Sikh War. The British were victorious in a number of battles, and, finally, in March, 1846, the Punjab was taken over as a British protectorate. Three years later, after the Sikhs had been completely conquered, the Punjab became a part of British India. Today most of the Sikhs live in the Republic of India. Amritsar is their holiest city.

SIL'ICA. The most common mineral on the face of the earth, silica is silicon dioxide. It occurs in the natural state as quartz, and in sand, sandstone, quartzite, flint, clay, granite, and chalcedony. Silica is used in the manufacture of glass, pottery, abrasives, wood filler, and paints, and is employed in small amounts in cosmetics and in tooth powders and pastes. See ABRASIVES; GLASS; QUARTZ.

SIL'ICON. A non-metallic element, silicon is found only in combination, being chiefly combined with oxygen. The dioxide, silica, is the most common mineral in the earth's rock envelope, and among the elements occurring there, silicon is second only to oxygen in abundance. It is obtained in three forms: non-crystalline, as a brown powder which dissolves in alkali; in lead-gray crystalline leaves insoluble in alkali; and in crystalline needles harder than glass. In addition to the extensive use of silicon compounds, silicon is used in alloys with brass, copper, iron, and steel. Silicon in steel imparts magnetic qualities, and the alloy finds wide use in electrical apparatus.



Courtesy Belding-Heminway-Corticelli

CREATOR OF LUXURY FIBER

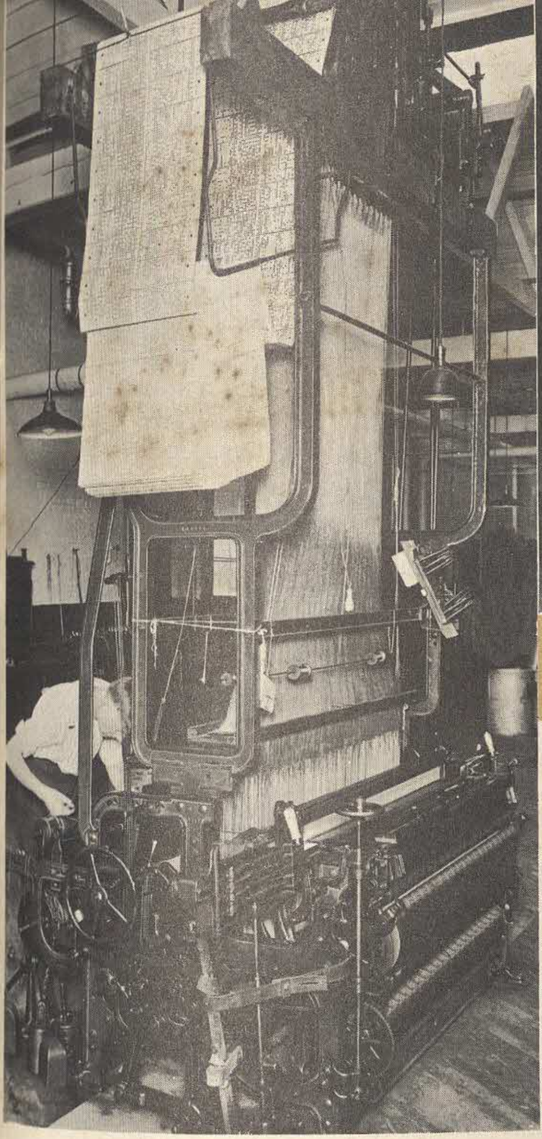
Left, above, mulberry silkworms about eighteen days old; they attain full size in about a month, live about two months. Right, a completed cocoon, ready to be dipped and reeled.

SILK. Basis of an age-old commerce between nations, silk is one of the most romantic and valuable of textile materials. Its soft and shining threads are not the fibers of a plant but the gossamer filament spun by the larva of a creamy-white moth.

Spinning Silken Riches. Although the silk moth has well-developed wings, it has lost the power of flight. It has also lost the power to exist in the wild state. The larva is nearly three inches long when full grown, is of a yellowish-white color when nearing maturity, and has a backward-projecting horn on the rear end of the body.

The silk is produced within the body of the worm in glands consisting of fine tubes which absorb through their walls the necessary materials from the blood. From two large reservoirs on the sides of the body a duct leads to the spinneret, a projection located just below the mouth. Silk, while inside the body, is a liquid. When it is forced out through the spinneret and comes in contact with the air, it immediately hardens and becomes a fine thread.

Silkworms are normally fed on leaves of



Photos by Brown Br

INDUSTRIAL REVOLUTION IN SILK

Inventions like the Jacquard loom (left) put an en
the hand looming of silk (above).

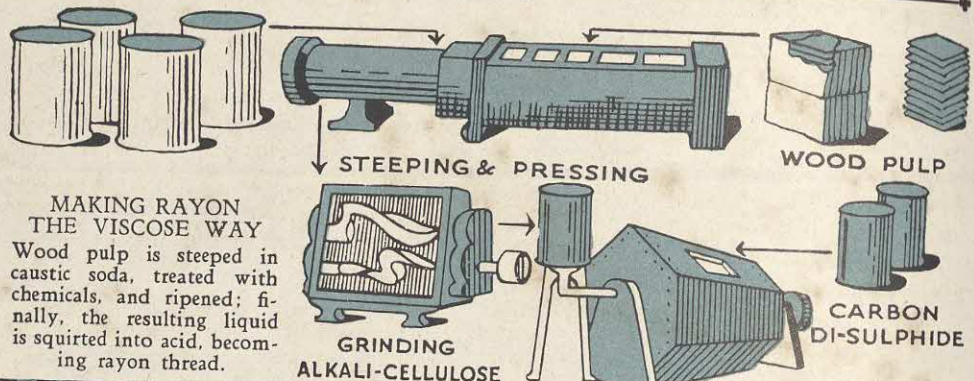
the white mulberry and grow to full size in about a month. If left to themselves, silkworms will fasten two leaves together and spin their cocoons between them. In silk culture, however, small cells are provided, in which the worms make their cocoons. Each worm attaches itself to the sides of a cell by means of the last several pairs of legs. Weaving its head and the fore part of its body back and forth, it spins about itself a loose shell and then, from the inside, builds this shell closer and closer to its body. The silk is covered with a gummy substance that cements all the threads together.

When a number of cocoons have been completed, they are dipped into hot water to soften the gum and to kill the silkworms so that they will not break the cocoons by emerging as moths. The silk from each cocoon is then wound on reels. One thread is so fine that several must be wound together to form the silk yarn for weaving, and about 1,000 miles of thread are needed for one pound of silk.

An Ancient Chinese Secret. At least 3,000 years B. C., the Chinese had discovered the art of making silk. It is believed that the art eventually passed from China to India and thence to Persia. It was many centuries, however, before silk culture was established in Europe, but Chinese silk found its way to Rome in the reign of Tiberius.

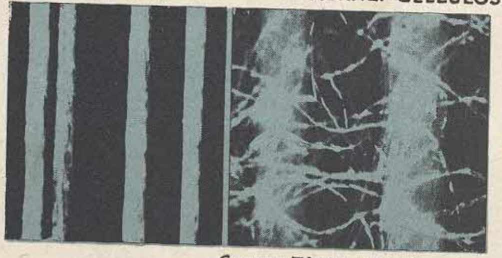
It was not until the time of Justinian that silkworm eggs were smuggled into Europe by two monks who obtained them in India. The silk industry was first established in Greece and later in Italy, France, Spain, and other countries.

Modern Silk Production. Chief producers of silk today are China, Japan, Italy, and France; the principal manufacturing countries are the United States and France.



MAKING RAYON
THE VISCOSE WAY

Wood pulp is steeped in caustic soda, treated with chemicals, and ripened; finally, the resulting liquid is squirted into acid, becoming rayon thread.



Courtesy The Du Pont Magazine

SMOOTH AND WHISKERED YARNS

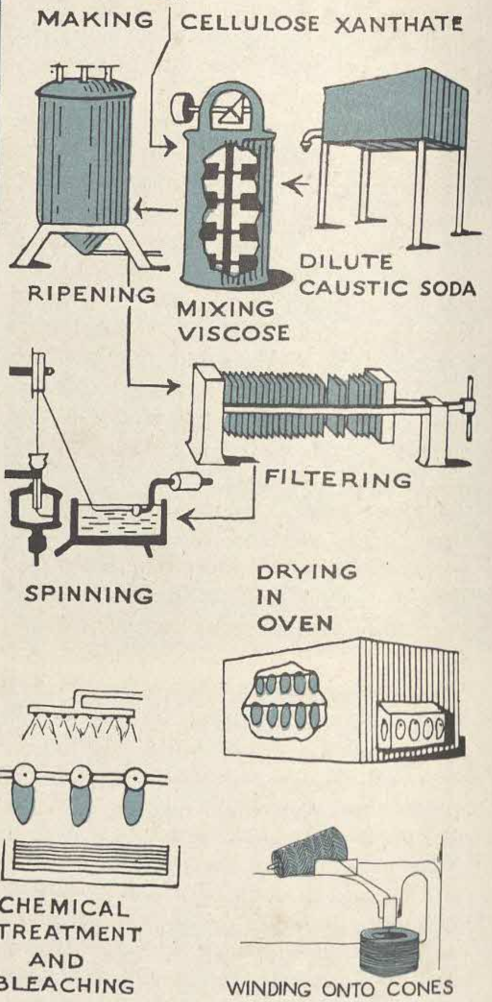
These photomicrographs show acetate rayon yarn (left) and the woollike *spun* acetate rayon yarn.

In the United States the leading silk mills are located in the Eastern states.

After the thread has been prepared, silk is woven in a manner similar to that suited to cotton and wool fabric manufacture. Because it is so fine, strong, and soft, silk can be made into many articles, ranging from very sheer hose to heavy upholstery fabrics. Elasticity, lightness, and durability are some of its other fine qualities.

Spun silk is silk yarn made by carding silk waste and spinning the short fibers by means of machinery similar to that used in spinning wool or cotton. Substitute silks made from cellulose and other substances are in wide use.

SILK, SUBSTITUTE. Among man's modern and most amazing accomplishments is his ability to make fabrics that closely resemble natural silk. First on the market were goods made from chemically treated cellulose. For these fabrics the United States Department of Commerce and various commercial organizations adopted the name *rayon* in 1924. Formerly, they were



called, generally, artificial silk. But this name was regarded as a misnomer, since the chemical structure of cellulose fabrics differs from that of silk. The many other chemist-created, "miracle" fabrics now used as silk substitutes or in combination with silk include nylon and orlon.

Rayon. In the making of rayon, cellulose from wood pulp or cotton is chemically reduced to liquid form, then combined with other chemicals and forced under high pressure through tiny holes in a "spinneret." The individual filaments which come from the small openings are twisted together to form single threads, which may be woven into cloth.

There are three basic procedures in manufacturing rayon in the United States. In the *viscose* method, sprucewood pulp is treated with caustic soda. In the *cellulose-acetate* method, cotton linters are treated with acetyl chloride. By the *cuprammonium* method, the linters are treated with copper hydroxide and ammonia. As a result of improvements in manufacture, rayon is as glossy or dull as desired, drapes softly, launders well, and is cheap and durable. It is, however, less elastic, strong, and elegant than silk.

Nylon. This exceptionally strong synthetic fiber is made chiefly from coal, water, and air. Introduced in hosiery in 1938, it was the first of all the "wonder" fibers to be created from nonliving materials; all the older textile fibers were derived from plants or animals. Nylon is made into fabrics, bristles, sheets, coatings, solutions, and various other forms. Cool to the touch and elastic, it resists moths and mildew, is washable and quick-drying, and needs little or no ironing.

Nylon is used in making practically all articles of clothing, including hosiery, sweaters, lingerie, dresses, suits, shirts, neckties, and rainwear. It is also widely used in upholstery materials, laces, surgical sutures, thread, yarns, ropes, fishing lines, tires, parachutes, wire insulations, and food covers. Many kinds of brushes now have nylon bristles.

SILK'WORM. See SILK.

SI'LO AND SI'LAGE. The preservation of green crops in storage pits and rooms called silos was introduced in the United States in the latter part of the nineteenth century. The purpose of any silo, regardless of its construction, is to preserve green crops in a condition suitable for winter stock feed.

Silos are usually built in the form of a vertical cylinder. They should be as airtight as possible to prevent the decay of the stored crops. Wood-stave construction was once the rule, but silos are now often built of stone, brick, tile, sheet metal, concrete, or cement blocks. Near the base is a small door through which the stored fodder, or silage, is removed. In some of the dry-farming areas, trench silos are dug in the soil to prevent evaporation.

Corn is the most popular silage crop, although sorghum, clover, and alfalfa are also stored. The crop is cut green, hauled to the tractor-driven silage cutter, chopped into bits, and blown through a stack into the top of the silo. If a crop is dry, it is often watered as it leaves the cutter. Properly kept, silage will be practically as green and nourishing at the end of the winter as it was when first cut.

SIL'VER. Valuable, venerable silver, cherished for its luster and whiteness, is a precious metal known since the earliest days of man. It is mentioned in the books of the Old Testament, and it is recorded that the first Greek coins were minted from silver obtained from the mines at Laurium.

Silver has many uses today. It is a better conductor of electricity than copper and is an excellent medium for conducting heat, but its cost prevents widespread use for these purposes. Silver combined with bromine, chlorine, and iodine is essential to photography in the form of emulsions for sensitizing film and paper. The great development of the moving-picture industry has increased the demand for silver for photographic purposes. Silver nitrate (lunar caustic), colorless but heavy, is used as a caustic to destroy warts and other undesir-

(6 and 7) Courtesy Reed and Barton

WORKING WITH A NOBLE METAL

(1) A typical silver-mining district in the Western United States. (2) Silver coin of 650 B. C. from Aegina. (3) Macedonian silver coin, 325 B. C. (4) Silver ingots recovered from photographic "hypo" solution. (5) Silver Chalice of Antioch, one of the earliest Christian relics. (6) Tableware. (7) Chasing.

able tissue, and in the manufacture of indelible inks, in silvering glass for mirrors, and in chemistry as a reagent. Silver is widely used for jewelry, tableware, implements, ornaments, and money. In the United States, silver coins actually are ninety per cent silver and ten per cent copper. Sterling silver is 92.5 per cent pure silver.

Pure silver weighs slightly more than ten and one-half times as much as water, and melts at 960.5°C. It is soft, ductile, and malleable, capable of being drawn into wires much finer than human hair, or beaten into amazingly thin sheets. The symbol of this element is *Ag*, from the Latin *argentum*.

Silver is found in a pure state, but more often it occurs in ores. The ores include *argentite*, a combination of silver and sulphur; *hessite*, silver and tellurium, *tetrahedrite*, a complex mixture of silver sulphides, antimony, and base metals; *dyscrasite*, silver and antimony; *cerargyrite* (horn silver), chlorine and silver, *pyrargyrite* (dark ruby silver), antimony, sulphur, and silver; *stephanite* (brittle silver), antimony, sulphur, and silver in different proportions, and *proustite* (light ruby silver), arsenic, sulphur, and silver.

There are many processes of extracting silver from its ores. See METALS AND METALLURGY.

Mexico leads the world in silver production. The United States is second; Utah, Idaho, Arizona, Montana, Colorado, and Nevada are the leading silver states. Other important producers include Canada, Peru, Australia, Bolivia, the Belgian Congo, Honduras, Japan, and Germany.

In 1934, when American production had fallen drastically, the Federal Government agreed to buy silver at a price that stimulated production. The government stores its silver at its mints and in its Depository at West Point, N.Y.

SI'MON PETER. See PETER.

SIMOOM', or SIMOON'. One of the chief causes of the discomfort and danger of traveling over wide desert regions is the hot, dry simoom wind, which sometimes attains very high speeds, carrying thick clouds of dust and sand before it. Whenever this wind starts to blow, the slow-moving desert caravans are forced to stop and the travelers lie down and cover themselves with blankets, while the camels bury their noses in the sand. The sand is blown at such speed that it will force its way through clothing and containers, no matter how tightly they are constructed. A simoom occurs when the air, heated by the hot desert sands, rises, and its place is taken by cooler air rushing in from all sides, forming a whirlwind. The wind destroys both plant and animal life and sometimes lasts for days at a time. It occurs chiefly in the Sahara and Arabian deserts.

SIM'PLON. Twisting its way across the jagged mountains, the Simplon is an important Alpine pass between Switzerland and the province of Piedmont in Italy. Over this pass, Napoleon constructed the great Simplon road in 1800-06, an achievement that still stands as a marvel of engineering. The road, which is carried over 611 bridges and through numerous tunnels, has a total length of forty-two miles, and a breadth of thirty feet. Here also is the Simplon Railway Tunnel, started in 1898 and finished in 1906. Consisting of two single-track tubes, it is the world's longest railway tunnel, over twelve miles in length. See ALPS.

SIMP'SON, JAMES YOUNG, Sir (1811-1870). For his discovery of the value of chloroform as an anesthetic, as well as his invention of a means to stop loss of blood in hemorrhage, Sir James Young Simpson won high rank in the annals of medical progress. Simpson was born at Bathgate, Scotland, and received his medical education at the University of Edinburgh. In 1847 he was chosen as one of Queen Victoria's physicians. For his discoveries in medicine he was widely honored by scientific societies, and in 1867 was made a baronet. See ANESTHETIC; CHLOROFORM.

SI'NAI. Jutting southeastward on the lower side of the Isthmus of Suez is the Sinai Peninsula, lying between the Gulf of Suez and the Gulf of Aqaba at the head of the Red Sea. Toward the south the peninsula becomes mountainous, rising to about 8,000 feet. One of the peaks is Jebel Musa, or Mount Sinai, thought to be the mountain on which Moses received the tablets bearing the Ten Commandments.

SINGAPORE'. A ship sailing from the Indian Ocean to the North Pacific must either pass Singapore or wend a long, circuitous route through the East Indies. It is this strategic position which made Singapore the "crossroads of the British Empire" and one of the greatest ports of the Orient. This great commercial city carries on an enormously valuable trade and is a vitally important center of the air routes which link the Far East with the rest of the world. It is located on Singapore Island, off the southern tip of the Malay Peninsula. It is the capital of Singapore State, a self-governing member of the British Commonwealth since June 3, 1959.

(1) Courtesy N.Y.K. Lines
(2) Courtesy Raymond-Whitcomb, Inc.
(3) Courtesy Cunard-White Star Ltd.

ORIENTAL CROSSROADS

Eastern trade and travel routes converge at Singapore, eighty miles from the equator. (1) Water front of the city, known for the kaleidoscopic beauty of its tropical scenery. (2) Viewing the town from a smooth-riding ricksha. (3) Slow but sure transportation suits these Singapore natives best.

Throughout the year the climate is hot, but healthful. The city itself is divided into European and native quarters. One of the world's finest botanical gardens is located here; there are modern government buildings, schools, churches, banks, and clubs. Singapore was considered the most impregnable naval base in the Orient, but the Japanese captured it in 1942 and occupied it until 1945. A large majority of the state's 1,515,000 people live in the capital and are Chinese.

SING'ING. There are two principles in singing which anyone may acquire and which would do much toward the development of the natural singing voice. These principles are proper control of the breath and the correct placement of the tone.

Most persons who know nothing of correct methods of singing fail to conserve their breath in such a way as to produce the best quality of tone. Anyone can discover the correct use of the breath by standing erect and taking a full breath which is permitted to be exhaled slowly, with a feeling of restraint in the abdominal region. After this exercise has been done several times, the syllable *lah* or *loo* may be sung softly; all the while the quality of tone produced should be watched.

This quality of tone cannot be of the very best type unless the question of tone placement is taken into consideration. The singer's own musical ear will serve as a guide in determining the most desirable quality of tone. The tone should be neither too much in the nasal passage nor too far back in the throat. The proper placement is dependent upon the correct production of the vowel sounds—a musical tone being merely the prolongation of the vowel sound.

The proper production of the vowel is dependent quite largely upon the correct position of the lips, tongue, and lower jaw. It is quite apparent that the same position of the lips which is used in the production of the vowel sound *ee* would not be used for *oo*. A simple and effective exercise for the development of a proper and uniform quality of tone on the various vowel sounds is to sing slowly the following ones in succession: *ee, a, ah, o, oo*. At first, exaggerate somewhat the lip positions in order to make a distinction. This simple exercise practiced upon various pitches of the scale within easy range of voice, together with a careful regard for the proper method of breathing, will very soon produce a marked improvement in the singing voice.

While the singing tone is produced upon the vowel sounds, it is important, for the clearness of enunciation, that the consonants be given sufficient attention. Many otherwise good singers fail in this respect, particularly in sounding the consonants coming at the end of the word.

There are many rules governing pronunciation in singing, but the one most commonly violated is that in the use of the word *the*. When *the* occurs before a word beginning with a vowel or *h*, it is pronounced *thee;* before all other consonants, *thuh*.

The importance of taking breath at the proper time is another factor in good singing. It is permissible to take breath at all punctuation marks. Taking breath between an article and a noun, between a personal pronoun and a verb, and after a preposition should be avoided.

Any young person possessing a musical ear and a reasonably pleasant singing voice may develop his singing ability by a careful regard for the principles herein outlined. A constant effort should be made to improve the quality of tone used, and to give an intelligent portrayal of the different sentiments expressed in the words of the songs.

SINGING TOWER. Enjoyed every year by thousands of visitors to Florida, the Singing Tower is a triumph of architectural beauty. It is at Mountain Lake on Iron Mountain, near Lake Wales, and stands on the highest land in Florida. The gift of Edward Bok, it was built as a token of his appreciation of the kindness and generosity of the American people.

The slender structure, built of Florida stone and pink Georgia marble, is 205 feet high, gradually tapering from its fifty-foot marble base to a summit thirty-seven feet wide. It is surrounded by a narrow moat over which stretch two stone drawbridges which are never raised. The tower is reflected in a pool on the northern side.

In the Singing Tower are mounted sixty-one bells, forming one of the world's largest and finest carillons. These bells are suspended on four levels and vary in weight from sixteen pounds to eleven tons. They have been acclaimed the most perfectly tuned carillon in use today. Frequent concerts are given during the winter and early spring months.

Surrounding the tower is a beautifully landscaped park of fifty acres, known as Mountain Lake Sanctuary. It is a veritable Eden of grassy glades, trees, shining pools, and shrubbery. Many of the shrubs are berry bushes, which assure not only a haven, but food, for birds. Numerous birdbaths are scattered about the area. This bird sanctuary, too, was the gift of Mr. Bok.

The tower was dedicated by President Coolidge in 1929, and about a year later became the tomb of its benevolent builder, Edward Bok.

SINN FEIN, *shin fayn*. Most influential among the groups that brought about the Irish Free State was the Sinn Fein Society of Irish Nationalists. The name Sinn Fein, from the Gaelic term meaning *ourselves alone*, was at first a motto, but was soon applied to the organization itself. In 1916 the Sinn Fein organized an armed revolt which was promptly crushed by the British, but the movement continued, and in December, 1921, a treaty was signed which

LEADER OF A WARRIOR RACE

This Ogallala-Sioux chief is a representative of the most difficult Indian tribe to subdue.

provided for the Irish Free State. In 1937 Ireland, or Eire, with the exception of Ulster, voted to set up an independent republic. See IRELAND.

SIOUAN, *soo'an,* **INDIANS.** Tribes belonging to the Siouan family of Indians were often a cause of trouble to the Federal government in the nineteenth century. Inhabitants of the upper Mississippi and Missouri valleys, they frequently resisted attempts of the white men to settle the region, the Dakota tribe especially being warlike. Other tribes of this family include the Omaha, Winnebago, Assiniboin, Osage, and Quapaw.

For additional information, consult the following articles:

Osage	Sitting Bull
Sioux	Winnebago

SIOUX, *soo,* **or DAKO'TA.** Long after most of the Indians tribes of the United States had given up their old ways and retired to reservations, the Sioux, or Dakota, Indians warred against the white men. A fierce and warlike people, they were the most difficult of all tribes to subdue, for they comprised the largest tribe west of the Mississippi, and extended from the Arkansas River to Lake Winnipeg, and from the Mississippi River to the Rocky Mountains.

In 1862 the Sioux, angry because an agreement with them had been broken by the Federal government, took to the warpath in Minnesota and killed nearly 1,000 settlers. Again, in 1876, they began fighting, and at Little Big Horn completely wiped out General Custer's force. They were finally subdued in 1891. Today about 31,000 remain, living on reservations in the Dakotas, Montana, Nebraska, and Minnesota. See CUSTER, GEORGE ARMSTRONG; SITTING BULL.

SIPHON, *si'fon.* To convey a liquid from a higher to a lower level and over a rise of ground between the two levels, a siphon is used. This is a tube bent in the form of an inverted *U,* with unequal arms. If the shorter arm of such a tube is placed in a basin of water and the tube is emptied of air, the pressure of the atmosphere will force the water up the shorter arm and out through the longer arm, provided the latter is below the surface of the water.

This principle finds practical application in hydraulic engineering. If an engineer wishes to drain a swamp and can run a pipe to land that is lower, without passing it over any rise of land more than thirty feet high, he need only pump long enough to fill the pipe. The siphon will do the rest. He cannot siphon the water over a ridge of more than about thirty feet because, as in the pump, this is the practical limit to which air pressure will raise water. If a farmer has a large gasoline tank near the barn and wishes to pipe it to supply tractors in the field, he can surmount an intervening elevation of perhaps forty-five feet, because gasoline is not so heavy as water.

Within the house a hose siphon can often be conveniently used to empty tubs or basins. We first plunge the hose in the water until it is filled, and then close one end with the hand until we have lowered the tube to another tub or the drain.

The principles of the siphon apply wherever water under no pressure except that of the air is piped over elevations. Water for irrigation projects and for drinking is carried great distances through siphoning systems. Oil is piped from oil fields in the Southwest to refineries in the Great Lakes region. In water-carrying pipes, air sometimes accumulates at the top of a rise and hinders or prevents the working of the siphon. To prevent this difficulty, escape valves are provided.

SI'REN. The high, piercing shriek of the siren, a noise-making device used on fire engines, police cars, ships, and in fog-warning appliances, is universally recognized as a warning of danger. Lighthouses use large steam-operated sirens as fog signals. Each siren has a trumpet attachment which throws the sound in the proper direction.

A simple siren consists of two circular discs, one of which revolves upon the other, which is stationary. Both have a series of holes cut in a circle about the axis. When air, steam, or gas is admitted, it passes through the holes in the fixed disc, and escapes through the holes in the movable plate when it revolves so that the holes coincide. When the disc is turning slowly, each puff is heard distinctly, but as it revolves faster, the puffs blend into one continuous note. The pitch of the note produced depends on the rapidity with which the revolving disc is rotated. As the speed of revolution increases, the pitch becomes higher.

SIRENS. Until Ulysses broke their spell, no man could prevail against the lure of the sirens, ancient Greek legends tell us. It is said that these sea nymphs had beautiful voices which lured mariners to their island. Then, when they had captured the men, the sirens would let them die by starvation. Ulysses, however, thwarted them by stuffing his companions' ears with wax and tying himself to the mast. When he escaped, the sirens hurled themselves into the sea, where they became rocks.

SIROCCO, *si rok'o.* In Italy and other lands on the north shore of the Mediterranean Sea, a regular feature of the climate is the sirocco, a hot, oppressive, southerly wind. The sirocco may be one of two types: moist and sultry and followed by rain; or hot and dry, bringing a dusty haze. Both types rise in the Sahara Desert and cross the Mediterranean Sea. The sirocco is especially strong in the island of Sicily. The name has been applied to other hot winds in other parts of the world.

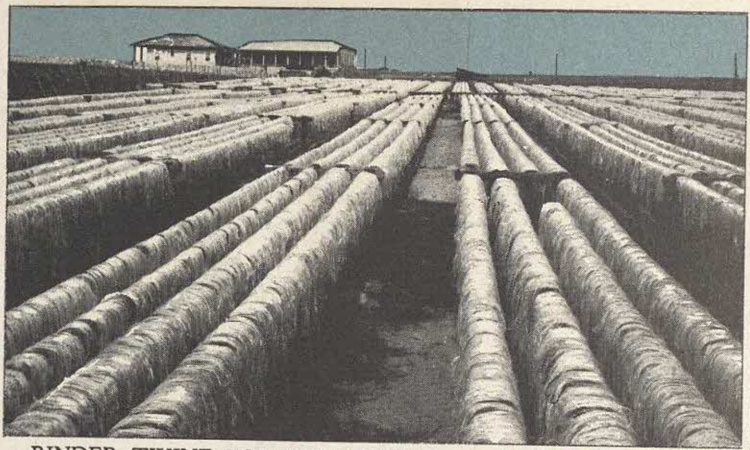
Courtesy International Harvester Company

CUTTING SISAL IN YUCATAN

Ten or twelve mature leaves are cut from the lower parts of the sisal plants twice each year. Leaves weigh about two pounds.

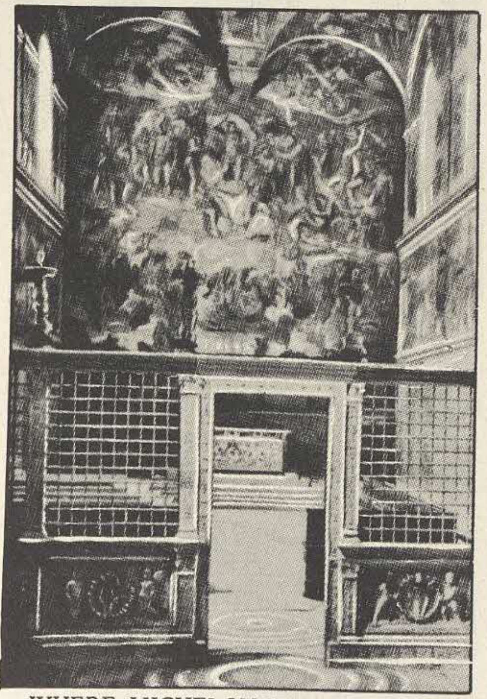
SISAL, *si'sal, se'sahl,* or *se sahl'.* Medium-grade twines and ropes are made from sisal, a plant which grows in Java, Yucatan, the Philippines, Cuba, and other tropical countries. The name is applied to the product of the henequen and other fiber plants, but properly refers to that of a species of the genus *Agave.*

The sisal plant consists of a rosette of straight, fleshy, dark-green leaves growing from a short trunk. The leaves are thirty to seventy inches long, and five to six inches wide. In a normal lifetime of five to fifteen years, the sisal plant will yield about 150 fiber-producing leaves. Each leaf yields only about three per cent of its bulk in fiber, which is obtained by crushing the



BINDER TWINE FOR THE WORLD
Above, racks of sisal bleaching in the hot sun. Below, decorticating machine which crushes pulp from leaves. Right, a hank of sisal fiber.

pulp from the leaves. The fiber is then gathered and transported to the drying racks. After drying, the fibers are shipped to mills, where they are made into twine and rope.



WHERE MICHELANGELO PAINTED
The Sistine Chapel, with the masterful frescoes of the great Florentine and other splendid decorations which draw Vatican sight-seers.

SISTINE, *sis'teen,* **CHAPEL.** Containing priceless art treasures, the Sistine Chapel is the private chapel of the Pope in the Vatican. It was built for the Pope in 1473 by Giovanni di Dolci, a Florentine architect. The chapel is now used for religious ceremonies in which the Pope personally participates and is also the scene of the Papal elections.

Among the beautiful works of art in the chapel is the magnificent marble screen which separates the congregation from the section reserved for the Pope and his cardinals. The floor consists of colorful mosaics, and the walls are covered with frescoes of such Renaissance masters as Botticelli, Ghirlandaio, and Perugino. On the ceiling are Michelangelo's famous *Creation, History of Noah, Prophets,* and *Sibyls.* The altar wall is covered with his *Last Judgment,* the largest fresco in the world. See MICHELANGELO BUONARROTI.

SISTINE MADONNA. See RAPHAEL SANTI; MADONNA; PAINTING.

SITTING BULL (about 1837-1890). Last of the great Indian chiefs, Sitting Bull also was one of the most warlike of them all. He was chief of the savage Dakota, or Sioux, and continually warred against the settlers of the Northwest. He was defeated in 1866 and pretended to make peace, but for years he continued to war on friendly Indians and outlying white settlements. When Federal troops set out to capture him in 1876, he surprised Custer at the Little Big Horn River and wiped out the force. Escaping to Canada, he was permitted to return to the United States in 1881 on the promise of a pardon. He continued, however, to rebel, and met his death while resisting arrest. See CUSTER, GEORGE ARMSTRONG.

SIVA, *se'va.* Representing the element of destruction, Siva is the third of the three great gods in the Hindu religion, the others being Brahma and Vishnu. In art he is shown wearing a necklace of human skulls and carrying a trident surmounted by a skull. His weapons are the bow, the ax, and the thunderbolt, and he wears usually a tiger skin. Strangely, the god is recognized as the enemy of love, but the patron of art and dancing. As the patron of the dance, however, he is worshiped only in Southern India.

SIX NATIONS, THE. See FIVE NATIONS, THE.

SKALDS, or SCALDS, *skawlds.* Viking heroes, kings, and warriors lived bravely and died triumphantly in the songs and poems of the skalds, the poets who were such an important part of Scandinavian life and literature from the ninth to nearly the end of the thirteenth century.

The skalds visited the courts of royalty, where they sang and recited their songs and verses. Frequently they traveled to other lands, where they heard the stories and songs of other peoples, and incorporated them in their own. These poets and singers, similar to the bards of Ireland, the troubadours of France, and minstrels of England, originated in Norway. By the middle of the tenth century, however, the finest skaldic literature was being produced in Iceland, where it played an important part in the development of literature. The great saga writers drew heavily on the skaldic works for their great epics of the Norse people.

SIOUX LEADER

Chief Sitting Bull, medicine man and warrior.

Skaldic poetry was very exact in form and phrase, and the rules of meter were strictly observed. Words for songs and poems were chosen with great care, and the use of substitute phrases was practiced. In fact, the form and rules of skaldic poetry became so inflexible and the use of figures of speech so abnormal that skaldic poetry grew to be understandable only to the skalds themselves. The result was that it declined. Snorri Sturluson, the great saga writer, was a leading skald, and wrote a treatise on skaldic literature.

SKATE. A broad and flat fish, the skate is a member of the ray family and is found on the sandy sea bottoms near the shore. The disclike body is formed by extensions of the pectoral fins. The tail is long and slender and the pointed snout has a sharp ridge. Species of the skate include the *common* skate, which is a foot or two in length and found on the North American Atlantic coast; the *barndoor* skate, four feet long; and the *California* skate, six feet long. Most species are edible.

SKATES AND SKATING. The earliest form of the Norse ice skate was an animal

BRIER SKATE
Skates (left) are not widely popular as food fish in America, but they are much sought after in Western Europe.

SPEED ON ICE
The hockey player must wear skates suited to both speed and fancy skating.

Courtesy The Athletic Journal

bone tied to the foot. Metal runners on wood were later used, and, today, skates are made entirely of steel.

The earliest ice skate in the United States and Canada consisted of a thick metal blade attached to a wooden shoe piece. Then came the *club* skate made entirely of metal. The blade was rocker-shaped, and sacrificed speed for fancy skating. Later came the long, straight-edged Norwegian skate commonly called the *speed* skate. The present *hockey* skate, a combination of the club and speed skate, is adaptable for both speed and fancy skating.

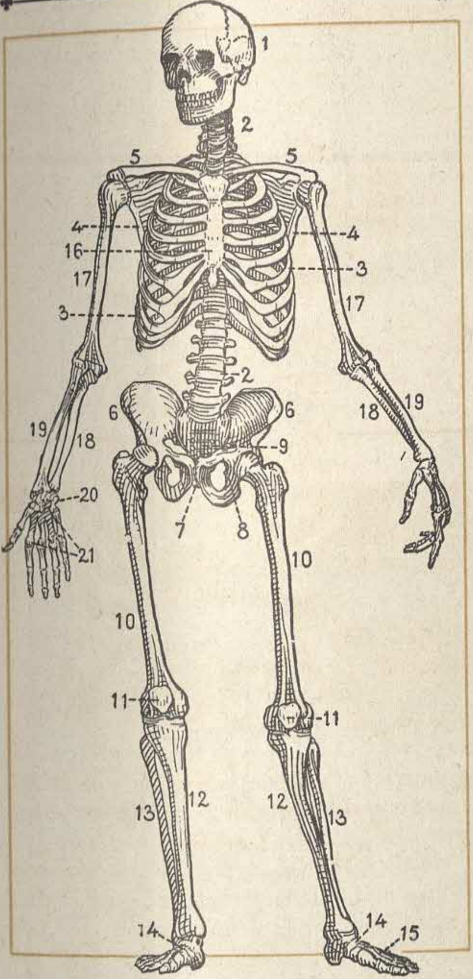
The stroke in ice skating is merely a forward glide with the knee of the skating leg bent. The free leg is swung entirely from the hip, knee slightly bent, the toe pointing down and out. The arms have free play from the shoulders, elbows slightly bent, palms downward or inward. The body is upright (though a racing skater usually leans forward), not bent sideways from the hips; shoulders are thrown back, chest expanded. The head is erect and the eyes are seldom looking at the ice. The beginner should work for proper form before attempting curve or figure skating.

In roller skating the form is essentially the same as in ice skating, but it is much more difficult to learn because the wheels do not adhere to the floor as the steel does to the ice.

For developing ease and skill and bringing out the individuality of the person, there is hardly any form of recreation that can compare with skating. Skating is one of the most popular contests in the winter Olympics (see OLYMPIC GAMES).

SKEL'ETON. In the human skeleton, bones and cartilage are fashioned into a strong framework which supports and protects the softer structures of the body, and affords attachments to muscles.

The Axial Skeleton. The skeleton is composed of two parts, *axial* and *appendicular*. The axial skeleton is composed of a rodlike structure made up of many segments, the vertebral bodies, which separate two canals, *dorsal* and *ventral*. The dorsal canal contains the nervous system; the ventral canal, the vital organs. The skull, an expansion of the upper end of the vertebral column, is itself divided into dorsal and ventral portions; neural arches enclose the brain, while below and in front of this organ, the face, a part of the ventral canal, contains the mouth, the beginning of the digestive tube. Below the ventral portion of the head comes the greater part of the ventral canal, whose bony walls are much



(1) Cranium. (2) Vertebrae. (3) Ribs. (4) Scapula, or shoulder blade. (5) Clavicle, or collarbone. (6) Hip bone. (7) Coccyx. (8) Pubes. (9) Sacrum. (10) Femur, or thigh bone. (11) Patella, or kneecap. (12) Tibia. (13) Fibula. (14) Metatarsal bones. (15) Phalanges. (16) Sternum. (17) Humerus. (18) Ulna. (19) Radius. (20) Phalanges. (21) Metacarpal bones.

less complete than those of the dorsal canal; they are formed by the ribs, costal cartilages, and breastbone, structures which partly enclose the digestive, circulatory, respiratory, urinary, and reproductive organs.

The Appendicular Skeleton. The appendicular skeleton, or framework of the limbs, is distinct in origin from the axial skeleton. It is described as having two girdles, one for the thorax, or chest, and the other for the pelvis; to each of these is attached a pair of limbs, the far ends of which radiate out in five branches, the bones of the fingers and toes. Toward the body there are the short bones of the wrist and ankle; then a pair of bones for the forearms and legs; next a single bone each for arm and thigh; and last of all the bony arches, or girdles. In human beings the thoracic girdle is made up of collarbone and shoulder blade, the latter attached so loosely to the ribs as to permit much freedom of action.

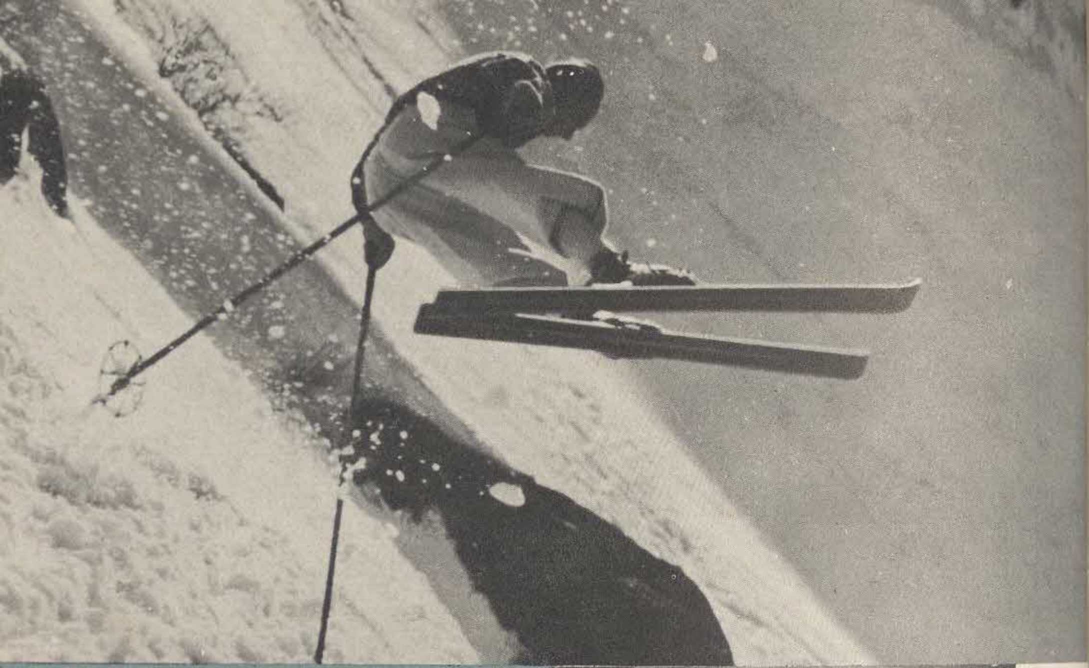
The pelvis is made up of bones which fuse together in such manner as to form one innominate bone for each side; uniting at the rear with the vertebral column, they constitute the pelvic girdle, affording support to the lower limbs and also forming part of the walls of the pelvic and abdominal cavities. In origin, the pelvis belongs not to the axial but to the appendicular skeleton.

For additional information, see the following articles:

Bone
Diaphragm
Foot
Hand
Joints
Ligament
Ribs
Spinal Column

SKI, *ske,* **or SKEE.** Skis, which originated in Norway so long ago that we have written records of them 1,400 years old, are still used as implements of travel in most countries of Northern Europe. In America the Norwegian skis have been perfected to suit the needs of the climate and snows, but the use is largely for recreation. The enjoyment derived from trudging, sliding, and jumping with skis can hardly be described to one who has not used them.

Skis are made of wood or metal, and a well-made pair balance. Particular delight is afforded the outdoor man in making his own skis. There is a relation between the height of the person and the length of the ski he should use. A short ski measures from the ground to about six inches of the head; a long ski measures to the second finger joint when the arms are raised straight upward. For general activities such as jumping, hill climbing, etc., the short ski is best. For level and flat country, the



W. Pote, from Ewing Galloway; Los Angeles County Chamber of Commerce

WINTER THRILLS FOR ALL

ove, an expert makes a "jump turn"; at right, a beginner prepares for a downhill glide.

long ski is best.

The skis are slightly narrower at the tail than at the front. The toe of the ski is slightly upturned, and the bottom is sometimes grooved to prevent the ski from slipping sideways. The feet are bound to the skis about two fifths of the way from the back end of the ski. Skiers often use a pair of ski poles as an aid in keeping their balance, in climbing slopes, and in increasing their speed.

Skiing does not require strength. It is essentially an activity demanding balance and nerve. Ski jumping is a feature of the Olympic winter contests.

SKIN, The. Covering the human body from head to toe is the skin, the tissue which regulates the heat of the body, contains organs of touch, excretes waste materials, and protects the body from infection.

The surface layer of skin, or cuticle, is called the *epidermis*. It is composed of innumerable cells, placed side by side and many rows thick. This layer has no blood vessels, but the lower rows of cells contain the pigment which determines the color of the skin. Hair and nails are parts of the epidermis which have developed abnormally to serve special functions. The epidermal cells grow from the bottom up, the surface cells dying and being shed in flakes.

Underneath the epidermis is the *dermis*, or true skin, which attains a thickness of one-sixteenth to one-eighth of an inch. The dermis has, on its outer surface, the *papillae,* which are the organs of touch. They are especially numerous at the finger tips, where circular grooves are formed by the epidermis between the rows of papillae. These form the fingerprints, which are unique with each individual. The lowest surface of the dermis is connected with the *areolar subcutaneous* tissue, which permits the skin to move without affecting the parts of the body beneath it.

The glands of the skin discharge sweat and oil. The sweat glands not only provide a means of excreting waste material from the body, but also cool the body in order that it may remain at a constant temperature. The oil glands are usually located in the hair follicles; they keep the hair glossy, and the skin from becoming too dry.

SKULL. See SKELETON.

SKUNK, or POLE'CAT. Among the best-known North American wild animals are the skunks. In the United States they are also called *polecats,* but this name belongs properly to a similar animal of the Old World. Skunks have black fur. There are two groups—the little spotted skunks and the larger skunks, usually marked with one or more wide, white stripes down the back. They are widely distributed in the woods and open fields, and are night prowlers. Skunks are equipped with a most effective weapon of defense in the two scent glands with ducts opening at each side of the vent, from which may be emitted two tiny sprays with an offensive odor. Unless startled by the suddenness of approach, skunks usually give fair warning by their menacing attitude and uplifted tail.

If left alone they occupy themselves in the twilight and hours of darkness searching for insects, mice, rabbits, birds and their eggs, and a great variety of other small animals upon which they habitually feed. They at times make forays into poultry yards. They grow excessively fat as the summer and fall seasons advance, and by the advent of winter are ready to cuddle away in a warm burrow to sleep.

Skunk pelts are highly esteemed on account of the beauty and excellent wearing quality of the fur garments made from them. Skunks are readily tamed and are frequently raised in captivity on fur farms, the scent glands being removed. See FUR AND FUR TRADE.

SKYE TERRIER, *ski ter'i ur.* A small dog, eight to ten inches in height, the Skye terrier is native to Scotland and takes its name from the island of Skye, one of the Hebrides. It has a long body and short legs, and its sandy, gray, or black hair reaches to the ground and also covers its eyes. The Skye is a good rat dog.

SKY'LARK. See LARK.

SLATE. A metamorphic rock which has the property of splitting into thin sheets, slate finds its greatest use as roofing and in the manufacture of blackboards, billiard tables, and electrical appliances. Slate is formed when shale or clay is subjected to great pressure and heat in the earth. It occurs in thin, parallel planes which can be easily split into thin sheets. In the United States, slate is quarried all through the Appalachian Mountains, but most of the commercial slate comes from quarries in Vermont and Pennsylvania. The world's finest slate is quarried in Wales. Slate is of different degrees of hardness and fineness; colored varieties are sometimes used for decorative building effects. The most important use of slate is in the manufacture of asphalt roofing materials, where slate granules are used to surface the material.

SLA'VERY. In earliest times, when man existed by hunting, and among later pastoral tribes, slavery was virtually unknown, for there was little work to be done. The true origin of slavery was a natural outgrowth of two factors—the conquering of one tribe by another and the growth of agriculture to a place of dominant importance. An ancient form, practiced by African tribesmen, was the offering of wives and children as security for debt; if the obligation remained unpaid, the hostages became slaves of the creditor. In Western Asia, particularly in Persia, slavery was common. It was practiced by the Hebrews, and by the Assyrians and Babylonians. The great Egyptian pyramids were built by slave labor between 3000 and 1800 B. C. It was the custom among Oriental countries to enslave the people of conquered nations and cities.

The practice of owning slaves became common in Greece from about 1200 to 800 B. C.; slaves were commonly employed at housework, farmwork, and as artisans. As civilization shifted westward and Rome became the "hub" of the world, slavery also spread; slaves were used in the home, to farm the large estates, in the theaters, and even as gladiators. Many of them, particularly the captive Greeks, were well educated and soon dominated the medical and teaching professions; some of them were able to gain their liberty by this means. Some became freemen by serving their masters a certain number of years, some by buying their liberty; and others were freed outright by their owners.

The advent of Christianity had little effect on the status of the slave, although it did lend a ray of hope to this downtrodden class. Gradually, slaves were given a greater measure of protection and the declining institution was practically eliminated by Justinian in the sixth century when he placed agricultural slaves in the ranks of the *coloni,* workers personally free, but bound to the soil. Thus, there was no sudden change from slavery to serfdom, but rather a gradual transition. In the meantime, slavery continued to thrive in the East, with whites and blacks, heathens and Christians alike being brought under subjection by the Mohammedans in Asia and Africa. By the time of the Renaissance, serfdom had been largely abolished in Europe, although it persisted in Russia until about 1861.

Slavery in the Americas. With the colonization of Mexico, South America, and the West Indies by Spain and Portugal in the early part of the sixteenth century, slavery became established in the New World. At first, native Indians were forced to do the heavy labor. The rigors of slavery soon exterminated them, however, and the Portuguese found it necessary to import Negroes in 1510. Negro slavery was introduced into Virginia in 1619, and for several decades both Northern and Southern planters owned slaves. By 1804, most of the Northern states had emancipated their slaves, but in the South, especially after the invention of the cotton gin, slavery became an accepted institution.

Opposition to slavery began to make itself felt early in the nineteenth century. The abolitionists were its active opponents on moral grounds, while the Northern farmer feared the competition of the Southern plantation owner, who benefited by slave labor. Efforts at placating both factions with such legislation as the Missouri Compromise, the Compromise of 1850, and the Kansas-Nebraska Bill failed. The controversy rapidly developed into one involving states' rights. When, in 1860, Abraham Lincoln was elected on an anti-slavery platform, the South saw its very existence threatened, and eleven states seceded from the Union, precipitating the Civil War. The Emancipation Proclamation of 1863 and the Thirteenth Amendment to the Constitution officially ended slavery in the United States. The Fourteenth and Fifteenth amendments made them citizens and defined their rights.

Slavery Today. Denmark was the first nation to abolish the slave trade (1792), and by 1890 slavery had been made illegal in most of the civilized countries and their colonies. Nevertheless, some 2,000,000 Ethiopians remained in bondage until 1936, and Germany forced hordes of citizens of the countries it conquered during World War II to work as slaves in its factories and mines. Soviet Russia and its satellites maintain huge slave-labor camps and compel political prisoners to do various kinds of hard work, such as mining and laboring in the Russian Arctic. Some slavery exists today in parts of Africa and Asia. See CIVIL WAR IN AMERICA.

SLAVO'NIA, a region in Yugoslavia. See CROATIA AND SLAVONIA.

SLAVS, *slahvz.* Consisting of over 200,000,000 people, the Slavs, who live in Southern and Eastern Europe and in parts of Asia, are a branch of the Indo-European family. The Slavonic group includes the Great Russians, White Russians, Poles, Czechs, Slovaks, Slovenes, Serb-Croats, Ruthenians, and Bulgarians. Characteristics of the Slav type are: swarthy skin, black, brown, or gray eyes, stature a little shorter than average, and breadth of head. There is now no true Slav type, since there has been much intermarriage between Slavs and other groups, but the Little Russians of the Ukraine region are most like the early Slavs.

During the years before World War I, many of the Slavs were ruled by other peoples; but after the war, certain closely related Slavic groups formed separate states. Thus, Czechoslovakia, Poland, and Yugoslavia became independent nations, and Ukraine was made a constituent republic of the U.S.S.R.

The fortunes of World War II broke up Czechoslovakia and Poland, brought Yugoslavia under German occupation, and scattered and destroyed many Slavs. However, their indomitable spirit held fast to national ideals, and their countries were liberated by the defeat of Germany in 1945. See CZECHOSLOVAKIA; POLAND; YUGOSLAVIA.

SLEEP. The pages of literature are filled with songs and eulogies to sleep. Cervantes, for instance, in his immortal *Don Quixote,* describes it thus: "It covers man all over, thoughts and all, like a cloak; it is meat for the hungry, drink for the thirsty, heat for the cold, and cold for the hot. It is the current coin that purchases all the pleasures of the world cheap, and the balance that sets the king and the shepherd, the fool and the wise man even."

Sleep, which is a state in which the nervous system renews the energy that has been spent during waking hours, has long been a puzzle to scientists. Its manifestations are obvious. During sleep, the conscious activities of the mind cease; the heart, which pumps vigorously during waking hours, beats more slowly; we breathe less frequently, and the muscles relax.

But the reason for sleep is not so clear. It seems apparent that sleep is common to animals of the higher orders only, for simpler forms of animal life show no indications of sleep, or even fatigue. Many theories have been advanced, but few have been accepted, as probable explanations of the phenomenon. One, which partially explains sleep, is that when we have been awake for a certain period, the muscles and nerves grow tired and relax. This decreases the activity of the muscles and they send fewer nervous impulses to the brain. As the impulses continue to decrease, sleep is induced, because the brain has a chance to rest.

Adults usually require approximately eight hours of sleep each night; children need from ten to fourteen hours, and infants generally sleep most of the day (in this connection see the article HEALTH). See, also, DREAMS.

SLIME MOLDS. Among the lower forms of life which have traits of both plants and animals are the slime molds. Biologists find it difficult to classify them, but they are regarded by some botanists as very simple forms of fungi, plants that belong in the same branch as bacteria and algae. Most of the slime molds live on decaying wood, fallen leaves, or other decomposing matter, but at least two diseases of cultivated plants are caused by parasitic forms. These diseases are clubroot of cabbage and powdery scab of potatoes.

Slime molds have a peculiar life cycle. The vegetative body is an irregular, slimy mass of protoplasm without a cell wall. In this form the slime-mold cell is capable of flowing movements similar to those of the amoeba. The mass of protoplasm creeps slowly along, taking in food. In the next stage the mass comes to rest and changes into spores. These spores give rise to amoeba-like bodies which in turn develop into masses of naked protoplasm, completing the life cycle. See AMOEBA; PROTOPLASM; SPORE.

TOPSY-TURVY LIFE

The slow-moving sloth spends almost its entire life upside down. It walks and sleeps suspended beneath the branches of forest trees, holding itself securely with powerful hooked claws.

The Travelers Insurance Company

SLING. Before firearms, the sling was a powerful weapon, capable of inflicting death. In a Biblical story, it was used by David to slay the giant Goliath. It is still used as a sporting implement by boys, and by Indians and cowboys of South America. It usually consists of a piece of leather to which are attached two strings. The projectile, which may be a stone, is placed in the leather strap. The thrower grasps the strings in one hand, whirls the sling around his head, and then releases one string so the missile flies toward its target.

The South American sling, the *bala,* is a long rope with a heavy weight at one end. It is thrown in a manner to entangle the legs of an animal, serving the same purpose as the lasso of North America. A modern version of the sling, the *slingshot,* has elastic strings attached to a leather strap at one end and to the prongs of a Y-shaped stick at the other. When the strap is pulled back and released, the missile flies out between the prongs.

SLOE. From two to fifteen feet tall and bearing masses of delicate white flowers, the sloe is a thorny shrub or small tree of the Plum family. It is valued for its purplish-black fruit, about the size of a cherry, used for preserves, jellies, and beverages.

SLOTH. The slow-moving, squat sloth is an interesting mammal found in South and Central America. It has difficulty walking on the ground and spends most of its life in the trees. Its claws, long and curved inward, enable it to hang upside down and crawl along branches. There are two groups of sloths. The *unaus* have two toes on the front feet and three on the hind; the *ais* have three toes on each foot. All the sloths are without tails.

SLOVAKIA. Once a part of Hungary, Slovakia became a part of Czechoslovakia when that republic was organized after World War I. In 1938 it became an autonomous province in the reorganized Czechoslovakia, and on March 14, 1939, declared itself an independent republic. Under a treaty with Germany it then became a vassal state of the Reich. On July 21, 1939, it adopted its Constitution, with a Catholic priest as President. When Germany surrendered to the Allies in 1945 at the end of World War II, Slovakia was reunited with the Czech republic. Slovakia has an area of almost 15,000 square miles. Its capital city is Bratislava, called in German by its former name of Pressburg. See CZECHOSLOVAKIA.

SLO'VAKS, a division of the group of people known as the Slavs, live mostly in Moravia and Slovakia, regions of Czechoslovakia. Before World War I, the Slovaks were governed by Austria-Hungary; after that war they joined the Czechs to form the independent republic of Czechoslovakia. A part of the Slovaks came under the German rule by the Munich agreement in 1938, and the rest in 1939, when Germany partitioned Czechoslovakia. Czechoslovakia became a satellite of the Soviet Union after World War II. See CZECHOSLOVAKIA.

SLOVENES, *slo veenz'*. A branch of the Slavonic language group, the Slovenes live north of the Adriatic Sea in the districts of Carniola, Southern Carinthia, and Styria, formerly parts of the Austro-Hungarian Monarchy. These people united with other Slavic groups to form Yugoslavia. See YUGOSLAVIA.

SLUG. This small, soft-bodied animal, a common garden pest, looks much like a snail without a shell. The slug is grayish, yellowish, or black, and may range in length from less than an inch to an extreme of nearly four inches. Its head, like that of the snail, bears two tiny hornlike structures; and the entire body rests on a single round, muscular foot.

From an opening in front of its foot, the slug lays down a pathway of slime, or mucus, along which its body moves. The mucus also helps the slug to cling to plant stems or other smooth surfaces.

Slugs spend most of the daylight hours in damp, cool places, and often may be found on the moist ground under stones and old planks. They move mostly at night, when they go out to feed on growing plants or decayed vegetable matter. The smaller varieties are most common in North America. See SNAIL.

SMELL. The philosopher Kant is said to have called smell "taste at a distance." Like sight and hearing, smell is a sense which we can exercise without coming into contact with the source—in this sense it does work at a distance. On the other hand, smell is unlike hearing in that it is not aroused by waves in the atmosphere, but by the actual presence in our noses of tiny gaseous particles. We can smell a rose more easily than an oak leaf because the rose produces a volatile oil; that is, one which is constantly giving off particles of vapor.

The sense of smell is communicated to the brain by the olfactory nerve, the end organs of which are in the upper part of the nose passages. To affect the nerve, the gaseous particles must be drawn in with considerable speed. This is the reason why we sniff when an odor is indistinct. See SENSES.

SMELT. In the winter, many of the rivers running into the North Atlantic and North Pacific oceans contain schools of small troutlike fishes known as smelts. These fish rarely grow to exceed a pound in weight or a foot in length. They are commonly greenish above and silvery-banded on the sides. They come up rivers to lay their eggs and, as they are excellent food fishes and are easily caught, they are sought in great numbers.

The *American* smelt is found in the streams flowing from North America into the North Atlantic. A similar fish is found in European streams. It has larger scales and is known as the *European* smelt. Streams flowing into the Pacific from San Francisco north have runs of *Pacific* smelt. They are smaller than American smelts.

SMI'LAX. This is the name of a genus of trailing and climbing plants of the lily family. The more than 200 species are widely distributed in temperate and tropical regions, but are most abundant in the tropics. A well-known North American species is the *greenbrier*, or *cat brier*, which grows wild in thickets as far north as Nova Scotia and south to Texas. It has a long, creeping rootstock and a stout green stem armed with prickles. The fruit is a blue-black berry. Another common species is the ill-smelling *carrion flower*. From certain South American species the flavoring sarsaparilla is obtained.

SMITH, ADAM (1723-1790). "Father of political economy" is the title commonly given Adam Smith, a Scottish economist and writer of the monumental *An Inquiry into the Nature and Causes of the Wealth of Nations.* Even though his title is not justly deserved, his work has become a landmark in the study of economics, and has had a profound influence.

Smith, a native of Kirkcaldy, Scotland, attended the universities of Glasgow and Oxford, and for twelve years was professor of logic and moral philosophy at the latter institution. In 1776 his *Wealth of Nations,* as it came to be called, was published. In this work he defended free trade, corrected many false impressions of earlier economists, and advocated the *laissez faire* doctrine of economics (see LAISSEZ FAIRE).

An uncompromising foe of monopoly and special privilege, Smith was vitally concerned with the welfare of the poor, and his economic policies were set forth in their interests. It is considered unfortunate that a man of Smith's attainments lived before the Industrial Revolution, which so radically changed the economic structure of the world. See INDUSTRIAL REVOLUTION.

SMITH, JOHN (1580-1631). Captain John Smith, a founder and one of the most influential men of the English colony in Virginia, was not only a soldier, but also an executive, historian, and explorer. His writings, although not fully substantiated by facts, have been used as sources for the history and geography of early America.

Born in Willoughby, Lincolnshire, England, John Smith followed the career of a soldier of fortune until he joined the first expedition of the London Company, which established a settlement at Jamestown, Va., in 1607. He gave valuable service to the struggling colony, making treaties with the Indians and mapping the region. Later, Smith was made governor of the colony. The famous incident in which Pocahontas saved his life is said to have occurred in 1609. In that year Smith returned to England, but in 1614 he again sailed for America and explored the New England coast. His books include *A True Relation of Virginia, A Description of New England,* and *The True Travels, Adventures, and Observations of Captain John Smith.*

BEST-KNOWN VIRGINIA SETTLER

Captain John Smith was energetic in his service as a colonizer, but he was inclined to be domineering and made many enemies. Eventually, he found himself fallen from favor with the London Company.

SMITH, JOSEPH (1805-1844). Founder of the Mormon sect, Joseph Smith was a picturesque figure in the history of the United States. He was born in Vermont, and moved with his family to Palmyra, N. Y., when he was ten years old. Here, at the age of fourteen, he announced that he had been visited by two angels who told him not to join any of the existing sects. At the age of twenty-two, after other visions, he claimed that he had been given golden plates on which were inscribed *The Book of Mormon.*

With Martin Harris and others, he then founded the Church of Jesus Christ of Latter-Day Saints, the Mormon sect. Becoming involved in commercial difficulties in Kirtland, Ohio, Smith moved to Missouri, then to Illinois, founding there the city of Nauvoo. Following a turbulent five years, he was arrested and placed in jail in Carthage, Ill., where he was shot by a mob. His followers later emigrated to Utah. See MORMONS.

SMITHSO'NIAN INSTITUTION. James Smithson, a British mineralogist, left his estate to a nephew with the provision that, if he died without heirs, the estate of $550,000 should go "to the United States of America to found at Washington, under the name of the Smithsonian Institution, an establishment for the increase and diffusion of knowledge among men." An act was passed by Congress on August 10, 1846, creating the present Institution.

The board of regents, which is the governing board, consists of the Vice-President of the United States, the Chief Justice, three members from each house of Congress, and six other United States citizens appointed by Congress, two of whom must be residents of the District of Columbia. An executive secretary handles the administration of the Institution. The board of regents has authority to receive gifts. The Smithsonian Institution promotes and carries on scientific investigations, issues a number of publications, and maintains an international exchange of similar publications.

Under the control of the Smithsonian Institution are: the United States National Museum; the Freer Art Gallery; the National Collection of Fine Arts (which includes the George P. Marsh collection of etchings and engravings, the Harriet Lane Johnston collection of European masters, the Ralph Cross Johnson collection of fine paintings, the William T. Evans collection of contemporary American artists, the John Gellatly collections of paintings and art objects); the National Gallery of Art; the International Exchange Service; the National Zoological Park; the Bureau of American Ethnology; the National Air Museum; the Canal Zone Biological Area; and the Astrophysical Observatory (consisting of the Divisions of Radiation and Organisms and of Astrophysical Research).

SMOKE. When substances containing quantities of carbon are burned, gases and little particles of unburned carbon, or soot, are given off. They comprise smoke, the color and density of which vary with the source. Bituminous, or soft, coal is very smoky, while anthracite, or hard coal, is comparatively smokeless. Wood, when properly burned, gives off little smoke.

In many large cities the smoke from industrial plants is such a nuisance that smoke ordinances are necessary to prevent damage to buildings and other undesirable effects. Usually, city ordinances require that some device be placed on chimneys to burn the carbon particles. In general, it is only necessary to supply a sufficient quantity of oxygen to consume the unburned material. New York City requires railroads to use only electric locomotives on Manhattan Island, a law which has helped materially in reducing the smoke evil there.

SMUTS. A number of cultivated plants are subject to diseases caused by parasitic fungi called smuts. The parasites especially prefer members of the grass family, such as wheat, oats, barley, and corn. In the small grains, smut always attacks the seeds, and infection is combated by means of chemicals. Corn smut, on the other hand, may break out on any part of the plant, and affected stalks should be cut and destroyed to prevent the scattering of spores. Crop rotation is also an aid, for smut spores cannot live in the soil for more than one season. The spores of smut occur in masses the color of soot, or smut, whence the name.

SNAIL, *snale.* Commonly enclosed in a spiral shell, snails are familiar small mollusks that live on land and in fresh or salt water. They may have peculiar gills or

SUCCULENT MOLLUSK
The French are fond of eating garden snails.

lungs, or structures to take their places. Some of those that live in water breathe with lungs.

A snail moves by means of a single foot, and in some cases this foot is modified into a fin used in swimming. The feet may secrete slime, which assists movement. Individual snails may be of one sex, or both sexes may be found in one animal.

Snails feed upon plant or animal matter and usually act as scavengers. They eat living, as well as dead, plants and animals, and are themselves eaten by many animals and by human beings. In Europe the common garden snails are eaten, and some forms are regarded as great delicacies.

Snails are found in most parts of the world, and some 49,000 species have been described. They are very numerous in Europe. See SLUG.

SNAKE. Distinguished by the complete absence of limbs, snakes belong to the reptile class. The bodies of snakes are covered with scales, and at various times they shed their skins, turning them inside out.

Snakes lay eggs or give birth to living young. The snake's tongue is believed by scientists to be used as an organ of feeling and is thrust out in front for protection. It is believed to serve also as an organ of hearing. Because of grooves in the jaws, snakes can easily stick their tongues out without opening their mouths. Their tongues do not carry poison, as many people believe. Sight in snakes is not believed to be of the best, and it is quite certain that just before they change their skins, the reptiles are nearly blind. A snake's eyelids are always closed, but it is able to see through a part of each lid.

Snakes swallow their food whole. They are able to do this because their jaws can spread and allow creatures to pass down their throats, although ordinarily their throats may be less than one fourth as wide as the creatures swallowed. The food of snakes is made up of animals which they are able to kill. As many snakes live on insects, worms, and mice, they may be considered very useful.

Some snakes merely swallow their victims; some squeeze them to death before swallowing them; and some kill them by poisoning and then swallow them. Some of the snakes which poison small animals are not dangerous to man.

Poisonous Snakes. The poisonous snakes are provided with sharp fangs which help in getting the poison into the blood of animals they attack.

Snakes in which the pupil of the eye is a vertical slit, and which have a pit between the eye and nostril, are dangerous poisonous snakes. Snakes in which the pupil of the eye is round and which have the body ringed with black, yellow, and red, with yellow on either side of the black, are coral snakes; they also are poisonous. Snakes whose eyes have each a vertical pupil, but which have no pit between the eye and nostril, are not to be feared, nor are snakes with a round pupil to the eye and other color combinations than those mentioned.

Very few people are ever bitten by poisonous snakes, because in most cases there is time to escape, and a snake only bites when forced by accident or intent to do so. If anyone is unfortunate enough to be bitten, the following suggestions may prove helpful:

(1) Shut off the circulation of the blood from the bitten arm or leg so that the poison may not get to other parts of the body.

(2) With a sharp knife or razor, open the bitten area and drain away as much of the poisoned blood as possible.

(3) Wash out the wound with a solution of permanganate of potash and water, strong enough to be of a deep wine color; or dust the wound with a powdered form of the chemical.

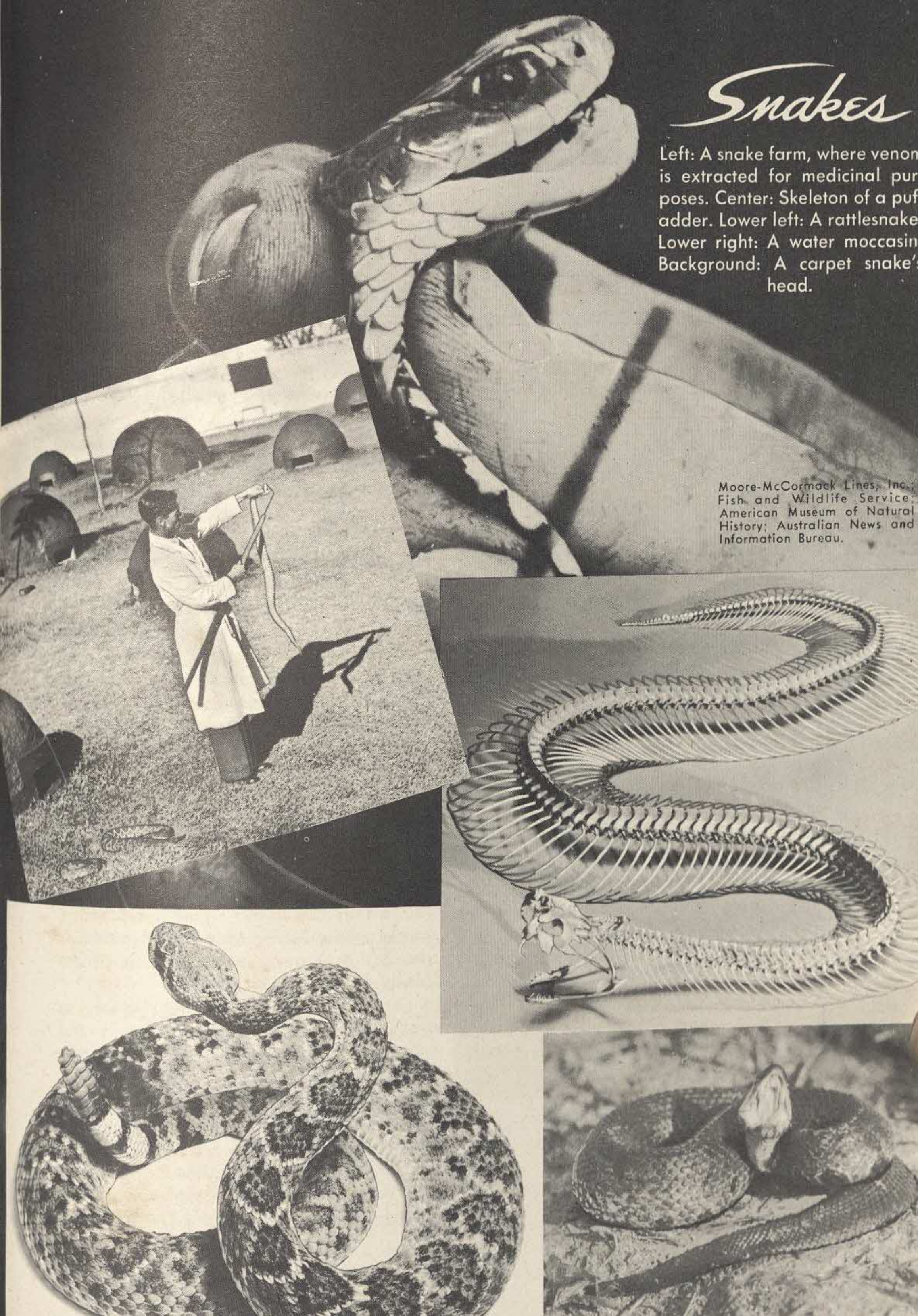
(4) Send for or get to a good surgeon as quickly as possible.

(5) Do *not* give whisky, at least not in large doses. See, also, FIRST AID TO THE INJURED.

For further information, see:

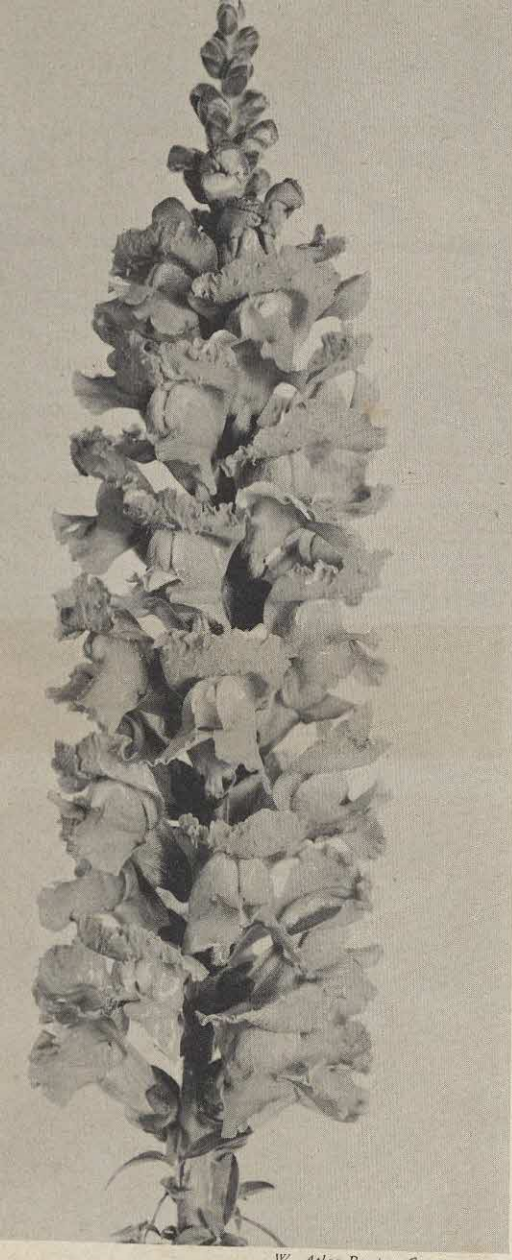
Anaconda
Boa
Cobra
Copperhead
Garter Snake
Moccasin Snake
Python
Rattlesnake
Reptiles
Viper

Snakes



Left: A snake farm, where venon
is extracted for medicinal pur
poses. Center: Skeleton of a puf
adder. Lower left: A rattlesnake
Lower right: A water moccasin
Background: A carpet snake's
head.

Moore-McCormack Lines, Inc.; Fish and Wildlife Service; American Museum of Natural History; Australian News and Information Bureau.



W. Atlee Burpee Company

SNOUT-FLOWER

The translation of the botanical name of this plant is *snout-flower,* but it is better known as snapdragon.

SNAKEBIRD. See Darter.

SNAKE DANCE. See Hopi.

SNAKE INDIANS. See Shoshonean Indians.

SNAPDRAGON. Most flowers are beautiful in form and color. Some have other attractions. The snapdragon is beautiful in its variety of colors and it is amusing in form. The translation of the Greek words from which its botanical name is taken is *snout-flower.* By placing one's fingers on each side of the flower and gently squeezing, the flower is made to open its mouth.

The stately spikes of snapdragon flowers may be pure white, yellow, pink, rose, orange, purple, crimson, maroon, lavender, or combinations of these colors. They have been a favorite in gardens for many years and they are now extensively grown in greenhouses for sale as cut flowers.

The snapdragon is really a perennial plant, but during severe winters in the temperate zones, it usually dies over the winter. Therefore, it is commonly treated as an annual. It belongs to the Figwort family and originated in Europe.

SNAPPING TURTLE. This name is applied to several fierce species of freshwater turtles that have the habit of seizing their victims with a snap of the jaws. Two species are well known in North America. One is the *common snapper;* the other, the *alligator snapper.* See Turtle.

SNIPE. Strictly speaking, the name *snipe* applies to only one genus of birds in North America, but it is a general name given a large family of shore or bay birds, including the woodcocks, dowitchers, sandpipers, curlews, yellowlegs, and several other kinds of common birds.

The only species of true snipe commonly found on the North American continent is the *Wilson snipe,* known also in certain places by the name *Jack snipe,* or *English snipe.* It breeds on the northern part of the continent through northern Canada and Alaska, and winters in the central part south to South America. The Wilson snipe is about eleven inches long, somewhat longer of leg than the woodcock, but with the same short tail and long, straight, sensitive bill which it uses for probing in mud and soft earth in search of food. The bird's general coloring is mottled gray, buff, brown, white, and black.

Fresh-water swamps and meadows are the favorite haunts of the snipe. It usually ventures out on the open shores only at night. Its mating and nesting habits are similar to those of the woodcock. It soars high into the air, then darts downward with a "bleating" or "drumming" wing sound at each rush. It has a loud cry like the words *scape-scape* and a soft mating call that sounds like *kuk-kuk-kuk-kuk*. Snipes are often hunted for food, but their flight pattern is such a zigzag that they are able to elude many hunters.

SNOW. Each winter, in the colder regions of the world, delicate icy crystals fall to the earth. In some places they may lay only a few inches deep, but in others a blanket many feet deep may cover the ground throughout the season. Snow is not, and should not be confused with, frozen rain. Snow consists of crystals of frozen vapor, created whenever precipitation forms at a temperature below 32° Fahrenheit. The moisture collects around tiny dust particles suspended in the air, then as it freezes and increases in weight, it descends through the air. Often many crystals combine to make a single snowflake of exquisite beauty and varying size.

Though snow often makes highway travel difficult and hazardous, it has many uses. To sportsmen, snow means skiing, tobogganing, sleigh rides, and other winter sports. To the farmer, it is an insulating protection for his winter wheat and for the soil. Snow protects the plants of the forest and, when it melts, renews the moisture in the soil.

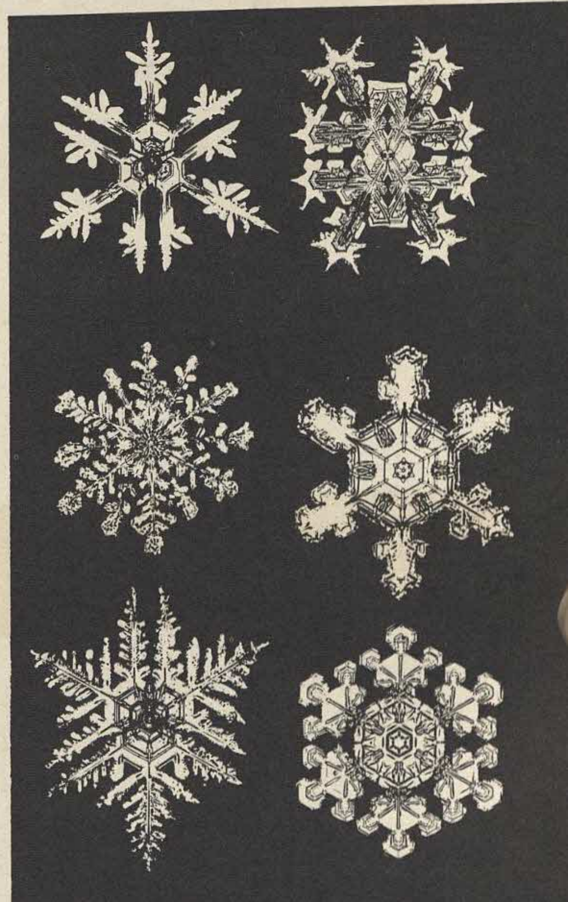
Snow crystals are fascinating to examine. One can catch snowflakes on a dark-colored cloth and look at them with a magnifying glass or under a microscope. There are beautiful designs of six-pointed stars, hexagonal tablets, prisms, and a variety of geometric forms. But with all their great variety, no two snowflakes seem to appear exactly alike. The designs depend upon the temperature and the amount of moisture in the atmosphere. The moisture in snow amounts to about one-tenth that of rain.

In much of the polar regions, especially in the Antarctic, there is always snow on the ground. In the middle latitudes, the ground is covered with snow each winter for several weeks, while in the tropics snow is scarcely ever present except in high clouds and on the tops of high mountains. In North America, snow rarely falls at sea level on the Pacific coast south of San Francisco, or on the Atlantic coast south of Cape Hatteras. Latitude, topography, and the direction of the snow-bearing winds control the distribution of snowfall. The greatest precipitation occurs on the west slopes of the Cascade, Sierra Nevada, and Rocky mountains, and on the south and east shores of the Great Lakes, the amounts ranging from fifteen to

DELICATE TRACERY

Each snowflake has its own intricate design, symmetrical or asymmetrical.

U.S. Weather Bureau



Weyerhaeuser Company

NATURE'S STOREHOUSE OF WATER

When snow melts it restores precious water to the soil, lakes, and streams. Snow also provides a protective background for the white winter coat of the snowshoe rabbit.

forty feet annually. The peaks of tall mountains are always covered with snow, regardless of their location, and the lowest point on a mountain where snow remains the year round is called the snow line.

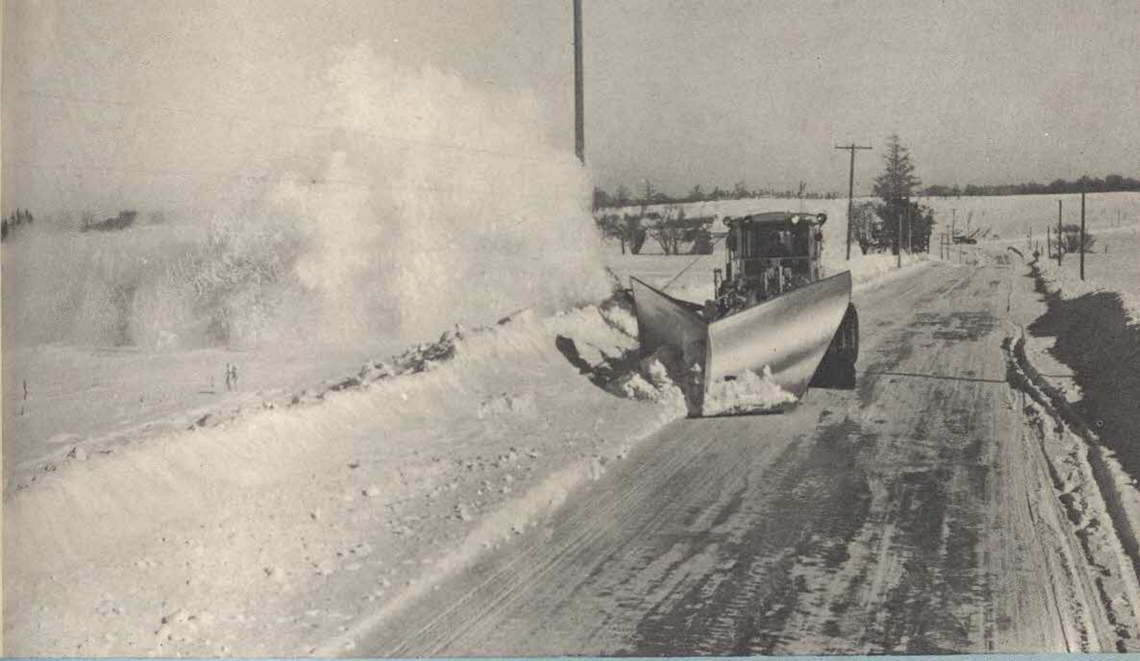
For additional information consult the following articles:

Avalanche
Crystallization
Freezing
Glaciers
Ice
Rain
Snow Line
Snowshoe

SNOWBALL, or **GUELDER-ROSE,** *gel' dur roze.* Growing from seven to twelve feet tall, the snowball is a flowering shrub named for its ball-like arrangement of tiny white blossoms. The name *guelder-rose* comes from Gelderland, a province of the Netherlands, where the plant is thought to have originated. It is a cultivated variety of the cranberry tree, but bears no edible fruit.

SNOWBIRD. See JUNCO.

SNOWDROP. Originating in Europe, but widely cultivated in the gardens of North America, the snowdrop is a comparatively small common plant which belongs to the Amaryllis family. There are many cultivated varieties. They grow from bulbs. The plant stems bear long, slender leaves, but the stalk of the flower is leafless,



Caterpillar Tractor Co.

WINTER GUARDIAN OF THE HIGHWAYS

This V-type plow is equipped with a blower to send the plowed snow flying from the road.

and bears a fragrant, white, bell-shaped blossom. Extremely hardy, the snowdrop is one of the first harbingers of spring.

SNOW LINE. In some places, even near the equator, it is so cold throughout the year that the snow never melts. Usually these are the high regions of the world—mountains or lofty plateaus—whose altitudes make them cold even in summer. The snow will remain only above a certain altitude, this limit depending partly upon the nearness to the equator. In some places in the Arctic and Antarctic regions the snow line reaches down to sea level. On the Alaskan coast it is 2,500 feet above sea level, and in Bolivia, very near to the equator, it varies from 6,000 to 18,500 feet.

Besides temperature, the amount of snowfall influences the height of the snow line. Because more snow falls on the windward side of mountains, the snow line may be several thousand feet lower even on a southern slope which is exposed to moisture-bearing winds, than on a protected northern side, as it is in the Alps and Himalayas.

Exposure to, or protection from, warm winds and the rays of the sun are other factors in determining the height of the snow line. Above this line are formed great snow fields and glaciers. See GLACIERS; SNOW.

SNOW'PLOW. Before the use of modern, motor-driven snowplows, a heavy fall of snow often closed all roads and railways in a region for many days. Modern devices, however, enable traffic of all kinds to move without interruption within a short time after a storm, except in case of prolonged snowfall. Snowplows are of several types, and are constructed of wood or steel. Some are placed vertically in front of a vehicle and inclined at an angle so that the snow is thrust to one side as the vehicle moves forward.

In clearing railway lines, V-type, wedge, and rotary plows are commonly used. The V-type plow is pushed before a locomotive or special car and removes the snow by being forced through it. The sides of the plow are set at oblique angles, so that the snow is lifted and deposited to the right and left of the track. The wedge plow acts in the same manner as a farmer's plow in the soil. The rotary plow consists of buckets fastened to a large wheel which rotates at right angles to the rails. As the wheel revolves, the buckets scoop up the snow and deposit it in a large hopper, whence it is thrown high in the air by a huge fan. This plow requires a special engine to turn the fan.

SNOW'SHOE. The first snowshoes were made by the Canadian Indians from birchwood bows webbed with caribou hide. Practical needs have taught the modern user of the snowshoe to make it from different materials. Nowadays, snowshoes are made with a bow of ash and a webbing of cowhide for the center, and lambskin for the filling of the toe and tailpiece.

The size and shape of the shoe depend on its use and the size and weight of the user. The Alaskans use an eleven-foot shoe for racing. The most popular snowshoe in North America is of the *club* pattern, which is from forty to fifty inches long and from twelve to fourteen inches wide. The size of the mesh (holes in webbing) for fine, dry snow is small; while for moist snow it should be larger. A shoe-sandal attachment fastens the shoe firmly to the foot.

It is easy to learn to use snowshoes. The snowshoe does not, however, keep the walker on top of the snow. The shoe will sink from two to five inches in any snow and must be lifted out on each step. This movement brings into play leg and calf muscles which are often undeveloped. Snowshoe walking will, therefore, be tiring for the beginner. He may, however, track the steps of someone ahead of him until he is practiced enough to break snow for himself.

An experienced snowshoer can cover from thirty to sixty miles a day with ease. The jar of the hard ground is missing, and the exercise is very invigorating.

SNUFF. Used for inhaling, for chewing, and for application to the gums, snuff is a powder manufactured from tobacco. An intricate process is involved in the conversion of tobacco into snuff and one requiring many months for its completion; the finished product is perfumed with sweet-smelling oils. Snuff was introduced into Europe from America in the sixteenth century and had a great vogue for a few centuries among the upper classes. Much artistry was expended upon the fashioning of expensive boxes in which to carry it.

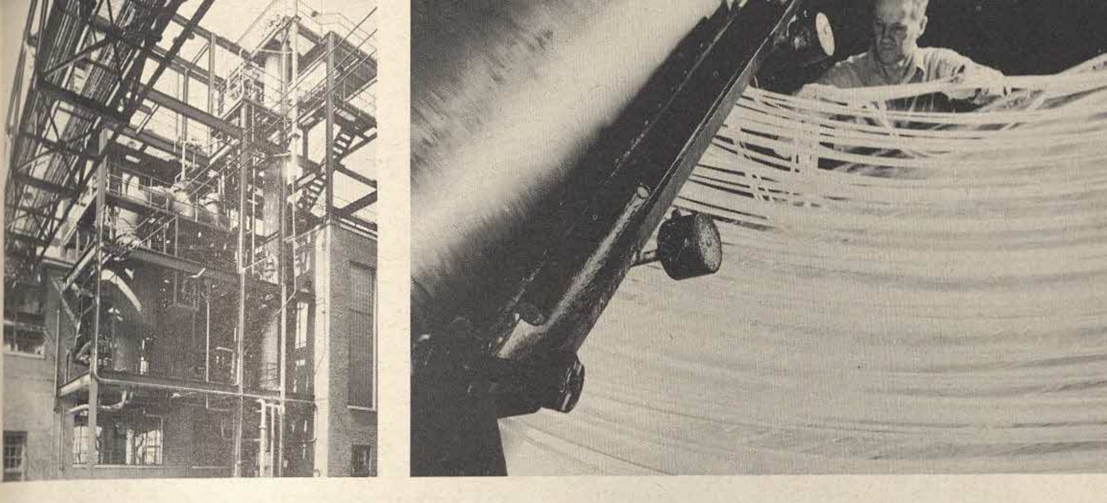
At the present time, snuff taking is no longer a fashionable habit. Formerly, it was supposed to exert a beneficial effect upon the mucous membranes of the nasal passages.

SOAP, *sope.* Despite the existence of soap for hundreds of years, it is still considered a luxury of civilization. It was known as a cleanser as long ago as the first century A. D.; but even during the Middle Ages and the Renaissance, royalty and wealthy persons preferred perfumes and oil on their bodies to water and soap. Today the peasants of some civilized countries continue to cleanse their clothes and bodies with water and hard rubbing and nothing else.

The commonest method of making soap is to boil tallow, palm oil, coconut oil, or some other fat with a water solution of the chemicals sodium hydroxide or potassium hydroxide.

In a typical process for making toilet soap, tallow and coconut oil are brought to a boil with wet steam. Caustic soda is gradually added during the boiling. Brine is added to prevent thickening, and later salt is shoveled in to "grain" the soap. The mixture settles into two layers, the fat on top and the spent lyes, consisting of salt, glycerine, and impurities, on the bottom. The spent lyes are drawn off, fresh lyes, rosin, and tallow added, and the boiling is repeated, usually twice.

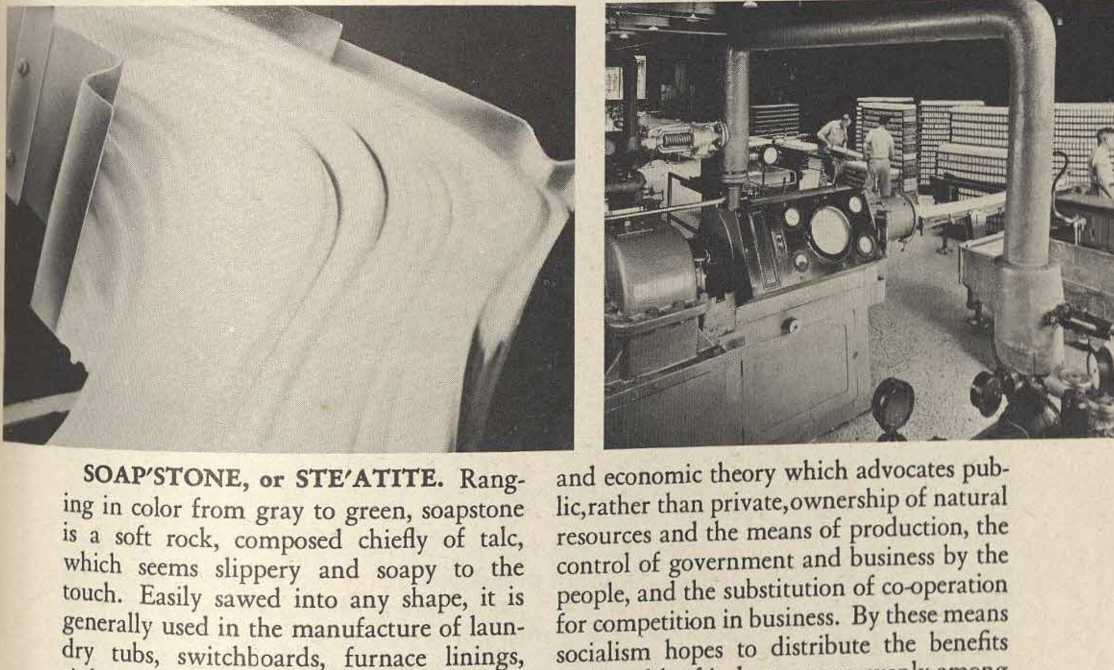
When tests show that the soap has been sufficiently boiled, it is cooled and cut into cakes or scraped off in thin chips to make *soap flakes*. Before it is made into cakes, some toilet soap is *milled,* that is, passed through rollers to remove the air and to give the liquid soap a fine texture. To make floating soaps, the mixture is usually beaten in a *crutcher* until it is air-filled, light, and fluffy. *Detergents,* the "soapless soaps," are really chemical compounds. They are generally made from petroleum or vegetable oils.



THE MANUFACTURE OF SOAP IS A FASCINATING, COMPLEX INDUSTRY

Stainless steel hydrolyzers, upper left, have replaced the huge kettles once used in soapmaking. Upper right, steam-heated dryers remove moisture from ribbons of flaked soap. Warm soap, lower left, pours from mixers. Lower right, soap from congealing machines is cut into strips.

Procter & Gamble



SOAP'STONE, or STE'ATITE. Ranging in color from gray to green, soapstone is a soft rock, composed chiefly of talc, which seems slippery and soapy to the touch. Easily sawed into any shape, it is generally used in the manufacture of laundry tubs, switchboards, furnace linings, sinks, and fireless cookers. Powdered soapstone is used to prevent friction in machinery, and a white variety is employed as tailor's chalk.

SOCIALISM, *so'shal iz'm.* Plans for the improvement of social conditions have been proposed since very early times; some of these plans have been grouped together under the general term *socialism*. Socialism, in general, may be said to be a political and economic theory which advocates public,rather than private,ownership of natural resources and the means of production, the control of government and business by the people, and the substitution of co-operation for competition in business. By these means socialism hopes to distribute the benefits and wealth of industry more evenly among all the people. Socialism is thus a plan whereby as many people as possible may benefit from wealth, rather than just a few. Socialism does not, however, advocate the use of force to change the existing order.

Why Did Socialism Arise? Before the Industrial Revolution, each individual provided for his own needs; and each family owned its own means of production. But with the Industrial Revolution came the factory system, in which the great mass of people no longer owned the means of production but worked for others who did. This system was the early capitalistic system in which the workers had little part. In many cases the owners of the means of production got more than their share of the wealth produced, and workers were often oppressed and frequently failed to receive even a living wage. This state of affairs led some men to believe that the social and economic order under capitalism was unfair to a great many people and should be changed to fit a new and fairer set of values.

Neither Communism nor Anarchism. Socialism is neither communism nor anarchism. Communism, which attempts to realize much the same ends as socialism, differs from it in that it advocates the forcible overthrow of the existing order. Communism also advocates the complete abolition of private property, but socialism advocates only the abolition of private capital. Anarchism is a theory which advocates the elimination of all government, but socialism advocates the extension of governmental power.

History. Socialism originated in the early injustices of the capitalistic system. Robert Owen, a famous English factory owner, was one of the first to try out socialistic theories in his factories. Next came the *state,* or *political,* socialism of the French socialists, such as Fourier and Saint-Simon. This form was followed by the *scientific* socialism of Karl Marx, the principles of which are set forth in *Das Kapital* and the *Communist Manifesto.* According to scientific socialism there is an inevitable conflict between workers and the owners of the means of production; eventually the working classes will arise in revolution and overthrow the old system. After the publication of Marx's work, socialism grew rapidly in all countries. The Marxian socialism became the basis of many of the principles now advocated by communists.

The Socialist party in the United States, never a major political group, wants government ownership of the key industries of the nation, such as public utilities, steel mills, etc., and natural resources. It advocates a great degree of popular control over government and industry. The party proposes to make these changes by legal, orderly means. See MARX, KARL; POLITICAL PARTIES IN THE UNITED STATES.

SOCIAL SECURITY. See OLD-AGE PENSIONS.

SOCIAL SETTLEMENTS. Usually located in the most congested parts of large cities, social settlements bring material and spiritual aid to the underprivileged. Famous Toynbee Hall, the oldest of them, established in 1884 and named for Arnold Toynbee, is in London's crowded East Side. The first efficient American organization of its kind, now called the University Settlement, was founded in New York City by Dr. Stanton Coit in 1887. Two years later, Jane Addams and Ellen Starr Gates opened Hull House in the heart of Chicago's foreign-slum district. Since then, social settlements have been established in many large cities.

Not all the settlements, however, have been in the great cities. One of the interesting attempts to live the plain, simple life in the open country and to do some manual labor each day was the Brook Farm experiment, just outside of Boston. At this place Hawthorne, Emerson, and a few others lived and worked for a time, but the plan was not carried far. Frequently, little rural groups have been drawn together by some common interest or purpose. Those following certain crafts have found that they have a tie sufficiently strong to bring them together. Some special social theory proves strong enough to unite others. Thus, settlements have grown up and flourished, for a time at least, in the open country as well as in the city. See HULL HOUSE.

SOCIETY. When a group of people live together and have many contacts with one another, they tend to think of certain things in the same way, they have the same feelings toward various objects, they have the same respect for certain institutions, and they develop certain traditional ways of living and doing things. These people form a society. A society, then, is a group of people living together, people who have in common many ideas, habits, traditions, sentiments, institutions, and beliefs, on the basis of which they establish a common bond and which they hand down to their descendants.

There are many different types of society. Not all have the same ideas, habits, institutions, sentiments, and traditions; but each one has a certain set of these things which are characteristic of that society alone. For example, in a democracy such as the United States, there is a certain set of ideas, habits, sentiments, institutions, and traditions; in the ancient feudal society the people had another set of ideas, traditions, and so on. The two societies are different, but each is a definite form of social organization.

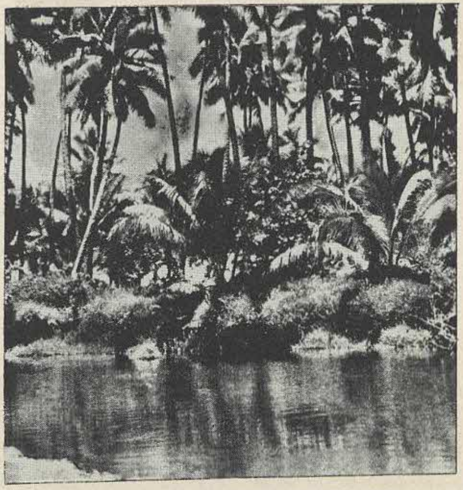
A society does not spring up suddenly; rather the ideas, habits, sentiments, and institutions which form the basis of any society develop over long periods of time until they are adopted generally and believed in by most of the people of the group. A definite form of society thus emerges. In the American Revolution the people took ideas, traditions, institutions, and sentiments which had developed long before their time; and because most of the people believed in them and agreed to abide by them, a definite form of society (democracy) emerged.

The kind of society we have depends largely upon our social heritage—the ideas and traditions which we inherit from our ancestors. We have a democratic society today because democratic institutions, habits, and traditions have been our social heritage and because the conditions of life make it possible. If we wished to build a new type of society, we should have to substitute new traditions, ideas, sentiments, and institutions for our present ones. Sometimes a social order collapses, as in the case of czarist Russia. Then man is forced to develop new traditions, institutions, and ideas to form the basis of a new society.

Consult the following titles for additional information:

Capital
Cave Dwellers
Civilization
Cliff Dwellers
Ethnology
Fascism
Feudal System
Government
Indians, American
Lake Dwellings
Socialism
Sociology

SOCIETY FOR THE PREVENTION OF CRUELTY TO ANIMALS. See CRUELTY TO ANIMALS, SOCIETY FOR THE PREVENTION OF.



TAHITI'S PALM-GIRT PARADISE

Typical of the lush richness of the Society Islands is this verdant river bank. Much of this fertility is due to heavy lava deposits.

SOCIETY ISLANDS. Lying in the South Pacific 2,500 miles to the south of Hawaii are the Society Islands, a French possession with a total area of 657 square miles. The Society Islands are divided into two groups, the Leeward and the Windward islands. Included in the former group are Huahine, Raiatea, Tahaa, and Borabora. The important islands of the Windward group, and of the whole archipelago, are Tahiti and Moorea. Papeete, on the island of Tahiti, is the capital of the whole of French Oceania.

These densely wooded isles are of volcanic origin and rugged in character, and their coast line is bordered by coral reefs. The climate, though hot, is not unhealthful. Coconuts, sugar cane, and fruits

SOCIETY ISLAND SOCIALITES
Grass skirts and colorful cottons are standard garb among the graceful Polynesian women.

are grown. The leading exports are copra and phosphates. The population, chiefly Polynesian, numbers about 66,500.

SOCIETY OF JESUS. See Jesuits.

SOCIOLOGY, *so si ol' o ji.* Everyone likes to study people and to try to understand what makes them behave as they do. Sociology, the science of society, is the study of people and their behavior and their relationships with one another. Although the idea of society seems unreal and abstract to the average person, the study itself is important; for it is in society that the personality develops and social characteristics of every individual are formed.

There are many different types of society, and each one has certain ways of doing things, certain ideas about things, certain feelings toward various objects, and certain institutions which the members respect and admire. When we are young, our families and teachers communicate all these things to us. As our own personality develops, it is greatly affected by all these things; and so society shapes our personalities and social characteristics.

The sociologist studies the ideas, ways of doing things, institutions, and sentiments of a society; and from such a study he can discover the broad, general principles which govern our mutual relationships. These principles explain why we behave the way we do under given circumstances. After the sociologist understands these principles, he is in a position to discover the causes of such social problems of society as crime, delinquency, and suicide, and can suggest means to eliminate these problems.

Modern sociology was developed from Auguste Comte's plan for a study of society which he set forth in his *Positive Philosophy,* published between 1830 and 1842.

Consult the following titles for additional information:

Capital Punishment
Census
Charity and Charities
Child Labor
Communism
Co-operation
Crime
Economics
Juvenile Court
Labor Organizations
Pension
Population
Prison
Prohibition
Socialism
Social Settlements

SOCRATES, *sok'ra teez* (469-399 B. C.). Not a line has come down to us in Socrates' own hand, yet the world knows him as the first of the three great philosophers of ancient Greece and as one of the greatest thinkers civilization ever produced. He was the teacher of Plato, who in turn had Aristotle for his pupil, and his influence on philosophical thought was profound and enduring. Socrates sought to educate the youths of Athens so that a better state might result. Above all, he was a persistent seeker after truth and the principles of virtue.

Ironically, Socrates, who was born in Athens, had only a scanty education. Yet his curiosity was unbounded and he studied philosophy eagerly. He began his career as a sculptor, but abandoned this profession to walk about the streets of the city, stopping all who would listen and questioning them

AND SO PASSED SOCRATES, IMMORTAL GRECIAN PHILOSOPHER

Sentenced to die for his teachings and alleged corruption of Grecian youth, this greatest of all martyrs and philosophers calmly took his own life by quaffing the deadly poison hemlock. Despite his enforced suicide, his truths and teachings will live on forever.

as to life and its problems. After three years in the army, he devoted himself entirely to philosophy and teaching, disseminating his great wisdom through simple conversations.

His reputation spread, and around him were grouped the most brilliant thinkers of the day, who absorbed his principles of honesty, morality, and humanism. Because of his teachings, however, he was charged with corrupting the youth of the state with unauthorized views of religion, and was sentenced to death. As was the custom, he committed suicide. With the calmness and philosophic repose that characterized his entire life, he drank the cup of poison hemlock while conversing with his friends. Plato said of him that he was "in death the noblest, in life the wisest and most just."

Socrates' philosophy is preserved in Plato's *Dialogues* and Xenophon's *Memorabilia*. From them we learn that his was no organized system of philosophy, but rather a general collection of truths and principles, which he followed in his own life. See ARISTOTLE; PLATO.

SODA. Comprising both manufactured and natural compounds, soda is the general name for compounds containing the element sodium. Among the manufactured compounds of sodium are sodium carbonate, or soda ash, which is used in making glass and soap as well as in disinfecting and cleaning. Others are sodium bicarbonate, the "common" soda employed in cooking and various medicinal remedies, and sodium hydroxide, or caustic soda, which is important in soap, dye, and paper manufacture and which is also employed in bleaching and kerosene-oil refining. See SODIUM.

SODA WATER. A sparkling, cooling drink for warm summer days, soda water consists of carbonated water mixed with flavoring. Although it now contains no soda, the name soda water has persisted from early days, when such drinks were made with bicarbonate of soda. Carbonated water is water containing carbon dioxide. This gas in liquid form is stored in steel cylinders under pressure. As it is released, it forms carbonic-acid gas, which imparts the bubbly, tart taste to the water. Such popular summer drinks as ginger ale, pop, and others consist of fruit and root extracts charged with carbonic-acid gas and kept under pressure in the bottle.

SO'DIUM. About two per cent of the earth's crust is made up of sodium, a very abundant metallic element. It is never found free in nature, but its chloride is widely distributed, occurring as rock salt and in sea water. Sodium nitrate is Chile saltpeter, a valuable fertilizer. Sodium sulphate, the carbonate, and many of its more complex salts, such as soda feldspar, are also found naturally. Plants and animals contain some of its compounds.

When commercially prepared, as by the electrolysis of sodium hydroxide, sodium appears as a silver-white, soft element that is lighter than water. It is very active and reacts violently with water, liberating hydrogen and forming sodium hydroxide. It tarnishes readily in air. Because it reacts so readily with moisture and the oxygen of the air, it is kept under kerosene. It finds its chief use because of its ability to reduce oxides of other elements and thus aid in their preparation. It forms with mercury an amalgam used in extracting gold.

The salts of sodium are very important commercially. The bromides and iodides are sedatives for nervous people. The chloride is common salt. The fluoride is an insecticide. Sodium thiosulphate is used in photography. Sodium silicate is water glass. Sodium sulphide is a bleach. The sulphate of sodium is Glauber's salt. Its hydroxide is caustic soda, a base of alkali. The symbol of sodium is *Na,* from *natrium,* the native sodium carbonate. See SALT; SALTPETER.

Deere and Company

SOIL. All life is rooted in the soil. It is the source of new wealth. Out of the earth's surface layer come food and clothing and shelter for the races of mankind. Because of these facts, the soil of a country is its most valuable natural resource. Soil is derived from broken-down rock and decayed vegetable matter. All exposed rock surfaces are constantly subject to the attack of the weather and keep crumbling away to supply material from which soil is formed.

In mountainous regions the broken-off rock particles roll or wash down the steep slopes as they are set free. Every mountain stands in a mass of its own broken-down material. Finally it will be brought low and will be buried in its own debris. On this broken-down rock material a true soil will form—a soil on which plants will flourish and man will find the opportunity of producing food.

A soil, as finally developed by natural processes, consists of at least two distinct layers. First, there is the surface-soil layer, usually dark in color, which varies in depth from a few inches to two feet and which contains most of the vegetable matter. Secondly, there is the subsoil layer, which lies beneath the surface-soil layer and which differs from it in being lighter in color and usually more compact, and in containing much less vegetable matter. Frequently, the subsoil is itself divided into two or more layers, differing in color and density.

It should be understood, then, that broken-down rock in itself is not soil. It is merely the material from which soil is formed. A true soil is formed only when sufficient vegetable matter (more commonly called *organic matter,* or *humus*) has accumulated in the surface layer of broken-down rock material so that the production of the higher plants is made possible. The presence of organic matter is essential to soil fertility since it supplies nitrogen, one of the most important elements of plant food.

We commonly think of rocks as unchanging and often hear the expression "enduring as the rocks"; yet there is no rock that is not subject to change.

The process by which Nature breaks down rocks is commonly known as *weathering.* When this process is merely one of breaking down the rock into smaller and smaller pieces, without the formation of new substances by chemical change, it is called *disintegration.* Such a change may come about through changes in the temperature of the rock surface, through the freezing of water in small cracks or crevices, or through the grinding action of ice or running water. When the process consists of chemical changes in the minerals constituting the rock, through which new substances or compounds are formed, it is called *decomposition.*

Such changes result from the dissolving action of water containing carbonic acid, or from the action of the oxygen of the air. As a rule both the disintegration and decomposition processes go on at the same time. However, the rate of rock weathering is very slow. Several thousands of years may be required for the accumulation of an inch of broken-down rock material.

There are thousands of different kinds of soil in the world. It is sometimes said that no two soils are exactly alike, just as no two people are alike. In spite of these great differences in individual soils it is, nevertheless, possible to classify them into groups, the soils of each group being in many ways alike.

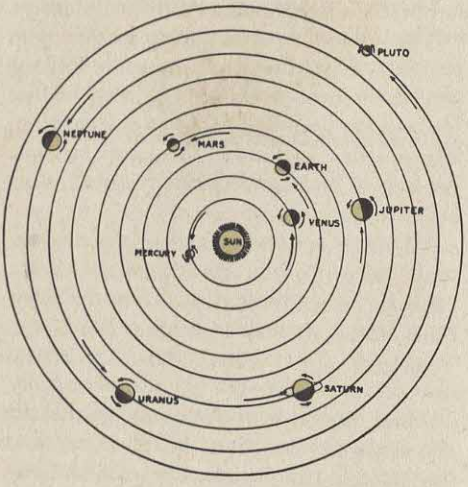
The most common method of grouping or classifying soils is according to the methods of formation and the materials from which they have been derived. According to this method, soils are divided into two great groups: (1) *sedentary* soils, or those formed from materials which have not been moved from the place of their origin; and (2) *transported* soils, or those formed from materials which have been carried from the place of their origin by means of water, wind, ice, or gravity.

From the standpoint of texture, soils are divided into three main classes—*sandy, loam,* and *clay* soils. Such terms refer to the fineness or coarseness of the soil particles. A handful of soil, as one takes it up in the field, is made up of three general groups of particles—coarse particles known as sand, medium-sized particles known as silt, and fine particles known as clay. The largest sand particles found in coarse-grained soils are about the size of a pinhead, while the finest clay particles are so small as to be invisible with an ordinary compound microscope. The texture of a soil depends upon the relative amounts of these three groups of particles found in it.

One can judge roughly as to a soil's texture by rubbing a small amount of the moist soil between the thumb and fingers. A sandy soil has a coarse, gritty feel and has little or no stickiness. A loam soil has a smooth and somewhat velvety feel and has considerable stickiness. A clay soil has a smooth, greasy feel, and is very sticky.

For additional information, consult:

Agriculture
Alluvium
Clay
Drainage
Dry Farming
Erosion
Humus
Irrigation
Loam
Sand



NATURE'S WHIRLING DERVISH

Nine spinning planets make up our solar system, all revolving and rotating about the sun in the same direction. Their orbits never cross.

SOLAR SPECTRUM. See LIGHT; SPECTRUM ANALYSIS.

SOLAR SYSTEM, *so'lur sis'tem.* The ancients believed for many centuries that the earth was fixed at the center of the universe and that the sun and other planets revolved about it. The work of Copernicus, Galileo, and Kepler in the sixteenth and early seventeenth centuries showed the old ideas to be false; that the earth is but one of the family of planets which revolve about the sun. The apparent movements of the sun and stars are the result of the movements of the earth itself.

The solar system is made up of the sun, nine planets with their satellites, over 1,000 small asteroids, or planetoids, meteors, and an occasional visitor in the form of a comet. So far as is known at present, all members of the solar system are made of the same materials.

The sun is the center of the solar system, the other members revolving about in elliptical orbits. The sun is not only the largest member of the solar system, but it is the primary source of light and heat for the other members. The sun is really a star, although it is so close that it appears much larger than the other stars. Of the immense amount of energy given off by the sun, the earth receives only a minute fraction.

Revolving at varying distances from the sun are the planets. Named in order from the sun outward they are Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, and Pluto. The five planets nearest the sun (not counting Earth) are easily seen with the naked eye and were known in ancient times.

For further information on the solar system, see the following articles:

Asteroids
Astronomy
Comets
Earth
Jupiter
Mars
Mercury
Meteor
Moon
Nebula
Nebular Hypothesis
Neptune
Planet
Satellite
Saturn
Sun
Uranus
Venus

SOLDERS, *sod'urz.* Two pieces of metal usually can be cemented by a process known as soldering. The material used is called solder, and there are two kinds, *hard* and *soft,* classified according to the degree of temperature at which they melt.

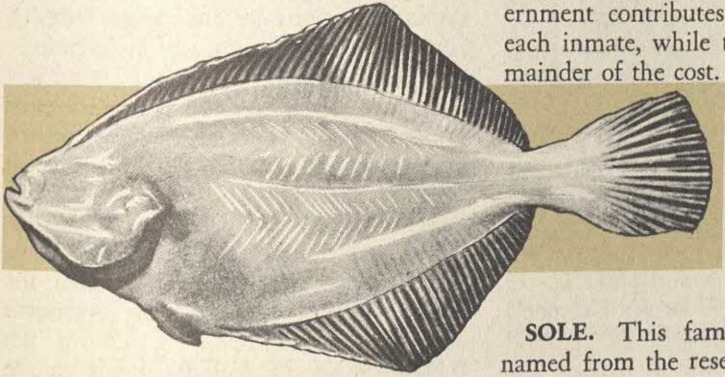
The soft solders melt with comparatively little heat, but they are very brittle and cannot be hammered. Of the soft solders, the most common are mixtures, or alloys, of various metals. Some of these mixtures are: tin and lead in equal parts; bismuth, tin, and lead in equal parts; and bismuth, two parts, tin and lead, one part each.

Hard, or brazing, solders often contain the same metal as that to be joined. To this is added another metal which melts at a lower point. Brass is a common metal used in a hard-solder alloy.

SOLDIERS' BONUS. On June 15, 1936, the United States government issued bonds to all certified World War I veterans in payment for service in the military and naval forces during the First World War. These bonds were technically known as adjusted service certificates, and were popularly referred to as the "bonus."

Provision for the bonus had been made in an act passed by Congress on May 19, 1924, but it was not to be paid for twenty years. However, veterans were permitted to borrow up to fifty per cent of the total amount due, at a specified rate of interest. Insistent demands by veterans' organizations resulted in the passage of legislation on January 27, 1936, for full payment on June 15 of that year. The act was vetoed by President Roosevelt, but was passed over his veto. Outstanding interest on money already advanced was canceled.

The adjusted service certificates were based on $1.00 per day for service in the United States, and $1.25 per day for service in France. Since $60 had already been paid each veteran at the time of his discharge, that amount was deducted from each payment. Veterans who had borrowed part of the money due them were credited with the balance in each case. The bonds were issued in $50 denominations to 3,468,967 veterans. The veterans were given the alternative of holding their bonds for future payment, these drawing three per cent interest, and maturing June 15, 1945. Some states awarded bonuses to World War II veterans.



TASTY SEA FISH

Unlike most fresh fish, the flavor of the sole actually improves with age—for a few days. When alarmed, he buries himself in the sandy sea bottom. True soles have eyes on but one side of the head.

SOLDIERS' HOMES. Disabled or aged men who have served in the United States Army are entitled to care in soldiers' homes supervised by the Federal Veterans' Administration. These homes are divided into two general classes: those maintained wholly by the Federal government; and those maintained by state governments with Federal aid. To be eligible for admission to a home, a soldier must hold an honorable discharge paper from the army.

The home for regular army soldiers who either have been disabled in service or have served twenty years in the army is the United States Soldiers' Home, located in Washington, D. C. For veterans in certain categories who are unable to earn a living because of some chronic condition, the government maintains homes, or domiciliaries, in the states of Florida, California, Arizona, Georgia, Iowa, Mississippi, New York, Ohio, Oregon, South Dakota, Tennessee, Texas, Virginia, West Virginia, and Wisconsin.

Many of the states maintain homes for those soldiers who are unable to enter a Federal institution. The United States government contributes a sum annually for each inmate, while the state bears the remainder of the cost.

SOLE. This family of flatfish is so-named from the resemblance of its members to the sole of the human foot. The European species, which average from ten to twenty inches long and are about one pound in weight, are among the most valuable of food fishes. The American sole, or *hogchoker,* is common enough along the Atlantic coast, close to shore, but it has no value as food, and fishermen usually throw it back into the water. It is smaller than the European type, ordinarily no more than six inches long. *Fillet of sole,* a popular fish preparation, is usually the flesh of flounder.

SOL'OMON. The greatest glory of the Hebrew nation was represented by the reign of King Solomon. Chosen by David as the one among his sons who should inherit the kingdom, he became the third king of Israel. For about forty years he ruled so wisely that his name stands for

SOLOMON PROVES HIS SKILL
Visited by the Queen of Sheba, who had vowed to baffle him with puzzling questions, the sagacious monarch dazzles his royal guest.

wisdom, and he was long regarded as the author of the *Proverbs* of the Bible, the book of wise sayings. It is related that in a vision, after he became king, Jehovah appeared and promised to grant him any request. His request was for wisdom to judge his people.

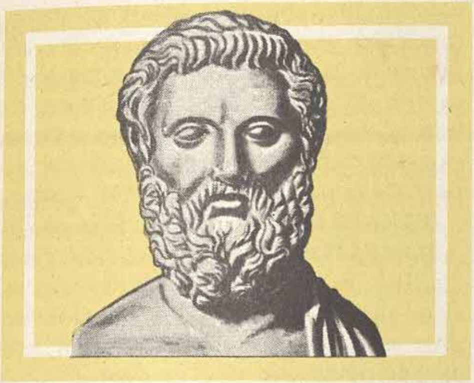
At his father's command, Solomon began his reign, as was customary, by destroying his father's enemies; he also had his brother Adonijah put to death because he had claimed the throne before David announced his successor. But once having destroyed those who opposed him, he turned his energies to making peace with other tribes and nations about him, and to increasing the wealth and power of his own kingdom. Seven years were spent in building the temple in Jerusalem, the great uniting symbol of the Hebrews; and thirteen years in completing his palace. An alliance was formed with King Hiram of Tyre, who furnished the cedars and firs of Lebanon in return for wheat and oil. King Solomon "made a navy of ships . . . on the shore of the Red Sea," and "Hiram sent in the navy his servants, shipmen that had knowledge of the sea, with the servants of Solomon." The fame of Solomon spread along the region of the Red Sea, and the Queen of Sheba (Southern Arabia) bore gifts and made her notable pilgrimage to Jerusalem to see if all were true.

It was evidently one of Solomon's policies to promote good relations with other peoples by taking wives from among them. Although polygamy was generally accepted in his day, marriage outside the tribes of Israel was not approved. It eventually brought criticism of Solomon from his subjects, particularly since he erected altars to the gods of his wives and himself offered burnt offerings on these altars. In order to maintain his magnificent court it became increasingly necessary to impose burdensome taxes upon his people. These two situations eventually brought about the division of the kingdom after Solomon's death. See JEWS.

SOLOMON ISLANDS. Lying in the Coral Sea about 700 miles east of the southern tip of New Guinea are the Solomon Islands. Taken from Germany in World War I, the northern islands are administered by Australia as part of the United Nations Trust Territory of New Guinea. The southern islands are a British protectorate. Some of the bitterest fighting of World War II occurred on Guadalcanal, Bougainville, and New Georgia while American troops were struggling to drive out the occupying Japanese. Covering some 16,000 square miles, the islands are densely wooded. Their inhabitants are chiefly primitive Melanesians.

SOLOMON'S SONG. See SONG OF SOLOMON.

SO'LON (639?-559? B. C.). Newspapers often refer to our lawmakers of today as *solons,* a term borrowed from the name of

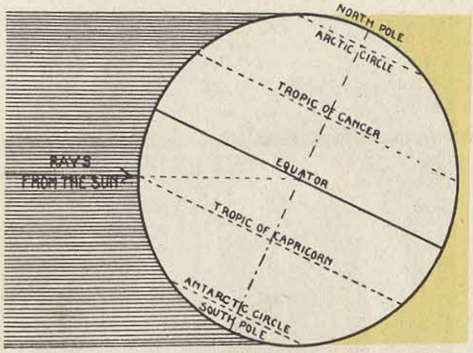


CHAMPION OF DEMOCRACY
One of the Seven Wise Men of Greece, Solon was the first great lawmaker of Athens.

a celebrated Grecian lawmaker and constitutional reformer. A well-educated noble of Athens, Solon spent his early days as a tradesman. In 594 B. C. he was elected archon, and in this office he brought about several economic reforms for the benefit of the common people.

The new laws provided for the cancellation of mortgages and debts of the poor, the limitation of landholdings, the opening of the legislative body to all classes of freemen, and the outlawing of contracts whereby a creditor could enslave a man for debt. The citizens were divided into four classes according to income, and taxed accordingly. Solon thus reduced the power of the aristocracy, and paved the way for democracy. On the completion of his program, he pledged the state to adhere to his system for ten years, and then left the country.

SOLSTICE, *sol'stis.* Twice each year the sun seems to check its march to the north or south. Each of these times we call a solstice; that is, a stopping or standing still of *sol,* the sun. The North Pole is alternately tilted toward and away from the sun at intervals of six months. Thus, as the result of the revolution of the earth, the sun's direct rays appear to shift north and south across the equator, reaching a point 23½° N. Lat. on or about June 21, and a similar position south of the equator six months later. These two positions determine the tropics of Cancer and Capricorn. The two dates when the direct rays reach the Tropics are known, respectively, as the summer and winter solstices. See SEASONS.



WHY IT IS COLD IN WINTER
During the winter solstice, the sun's rays fall vertically on the Tropic of Capricorn, while only slanting rays reach the Northern Hemisphere. This phenomenon, caused by the earth's tilting, brings us our winter season.

SOLU'TION. When a lump of sugar is stirred into a glass of water, it dissolves to form a solution. The liquid in which a substance is dissolved is called a *solvent;* the substance dissolved is the *solute.* Solvents may be liquids or solids; solutes include gases, liquids, and solids.

When a certain amount of sugar or salt is mixed with water, undissolved traces of the solid will begin to appear on the bottom of the glass; the solution is then said to be *saturated.* If the liquid is then heated, additional amounts of the solute will go into solution and it is then said to be *supersaturated.* In certain other cases, lowering the temperature will make supersaturation possible. Some very hard and apparently insoluble substances can be dissolved; for instance, flint glass will dissolve to a limited extent in aqua ammonia. *Pseudosolutions,* such as soap particles in water, are not true solutions, for the tiny particles have never been completely dissolved and may be removed by filtration.

SOL'WAY FIRTH, *furth.* Stretching inland for nearly fifty miles between Scotland and Cumberland County, England, is a picturesque arm of the Irish Sea known

SOLYMAN THE MAGNIFICENT
Under his militant reign, Turkey extended her sway over large areas of Europe and Asia Minor.

as the Solway Firth. Its greatest breadth is about twenty miles. In the spring, tides from three to six feet high rush into the firth at the rate of about ten miles an hour. With its plentiful supply of salmon and other fish, the firth is one of England's finest fishing grounds. Among the rivers which empty into it are the Derwent, the Dee, the Esk, and the Annan.

SOL'YMAN I, or SULEIMAN, *soo la'mahn,* **I,** surnamed THE MAGNIFICENT (1494?-1566). At no time in her entire history did Turkey rise to greater power and glory than she attained under the rule of Solyman I, who succeeded his father, Selim I, as sultan in 1520. Revolts in Syria and Persia disturbed the first year of his reign, but these were quelled. After signing a treaty with Persia, Solyman besieged and captured Belgrade in 1521. Two years later, the island of Rhodes fell before his forces, and the battle turned to Hungary, where, in 1526, he won an overwhelming victory at Mohacs.

A campaign against Vienna in 1529 saw the sultan defeated, but in the wars against Persia which followed, he gained a vast amount of territory. In 1535 he negotiated a treaty with France, giving that nation access to the Levant. A few years later the combined power of the Turkish and French fleets made him the supreme power in the Mediterranean. Not among the least of Solyman's achievements were his encouragement of learning and the improvement of Turkish law. See TURKEY.

SOMALI REPUBLIC. See SOMALILAND.

SOMALILAND, *so mah' le land.* From the Red Sea, the coast of Africa turns east along the Gulf of Aden for 400 miles, and then southwest for 600 miles. The strip of land along this coast is Somaliland. A small area at the head of the Gulf of Aden is French Somaliland; east is British Somaliland; and from the Gulf southwestward to Kenya, is Italian Somaliland. These sections were hotly disputed by Allied and Axis forces in World War II.

French Somaliland covers an area of 9,000 square miles. It is composed chiefly of high, arid plains, having a hot, dry climate. Its chief exports are ivory, skins and hides, coffee, gold, and salt. Fishing is important. The capital and leading port of the country is Djibouti. The population of French Somaliland is about 67,000.

British Somaliland, with an area of about 68,000 square miles, lies between Ethiopia on the southwest and the Gulf of Aden. The low, sandy plain along the coast rises abruptly to a range of mountains. Farther south is a second parallel range which descends to a plateau. The population of about 640,000 is made up chiefly of nomadic Moslems who are herdsmen. The principal exports of the country are cattle, sheep, goats, hides, skins, gums, and resins. On the moist slopes of the mountains, myrrh and frankincense are grown. Game includes lions, ostriches, and gazelles. The largest city and chief port is Berbera.

Italian Somaliland is a territory of about 195,000 square miles, mostly arid. Mountainous near the coast, it slopes to a plateau in the interior. In the south, the region watered by the Webi-Shebeli and Juba rivers is fertile and productive. The former Italian colony of 1,500,000 people was a United Nations Trusteeship until July,

1960. Then Italian and British Somaliland combined to form the Somali Republic. The legislatures of the two countries combined and a president was selected. The capital of the country is Mogadishu.

SONATA, *so nah′ ta.* A form of musical composition for one or two instruments, the sonata is written in three or four movements. Although the separate movements are in contrast to one another, they nevertheless form a related whole and are written in related keys. Usually a sonata begins with an *allegro,* or quick movement, sometimes with a slow introduction. The second is an *adagio, andante, largo,* or some other slow movement. The third is a lighter movement—*minuet* or *scherzo*. The sonata ends with a quick movement, usually in *rondo* form. A symphony is a sonata written for orchestra.

SONG OF SOLOMON. The twenty-second book of the Old Testament is the *Song of Solomon,* also known as the *Song of Songs,* the *Canticles,* and the *Psalms of Solomon.* It is a series of poems in celebration of marriage. Accepted as part of the Jewish canon at the time of Christ, it was also included in the Christian Bible. Until recent times, it was thought to have been written by Solomon, king of Israel. Today, however, critics attribute it to an unknown author, and there is disagreement as to the period in which it was written. Jews consider the song an allegory concerning the union of God and Israel, while Christians interpret it as symbolical of the relationship of Christ to the Church.

SON′NET. Some of the finest poems ever written are sonnets. The sonnet is a form of verse that originated in Italy. It always has fourteen lines, but the rhyming arrangement may vary. Shakespeare, whose sonnets are famous, used three quatrains and a couplet, with the rhyme scheme *a, b, a, b; c, d, c, d; e, f, e, f; g, g.* The Italian, or Petrarchan, form, used by Milton in his famous sonnet *On His Blindness,* has the following rhyme scheme: *a, b, b, a, a, b, b, a; c, d, e, c, d, e.* There are several other possible arrangements.

Usually, there is one central idea expressed in a sonnet, and in the English language the sonnet has been devoted mostly to serious themes. Italian, Spanish, and Portuguese sonnets are usually lighter in tone.

Besides Shakespeare and Milton, some of the best-known writers of sonnets in English literature are Wordsworth, Elizabeth Barrett Browning, Rossetti, Keats, and Shelley.

The following is a beautiful sonnet written by an American poet, Lizette Woodworth Reese:

When I consider Life and its few years—
A wisp of fog betwixt us and the sun;
A call to battle, and the battle done
Ere the last echo dies within our ears;
A rose choked in the grass; an hour of fears;
The gusts that past a darkening shore do beat;
The bursts of music down an unlistening street—
I wonder at the idleness of tears.
Ye old, old dead, and ye of yesternight,
Chieftains, and bards, and keepers of the sheep,
By every cup of sorrows that you had,
Loose me from tears, and make me see aright
How each hath back what once he stayed to
    weep;
Homer his sight, David his little lad!

SONS OF LIBERTY. Influential, patriotic, secret organizations of the American colonial period were formed to oppose those British policies which were unfavorable to the colonies. They arose after the Stamp Act in 1764, and rapidly gained members in all the thirteen colonies. Referred to a year later in a speech before the English Parliament as the "sons of liberty," they at once adopted this phrase as a name for their societies. In time, all such groups began to co-operate and were influential in securing the repeal of the Stamp Act in 1766. The Sons of Liberty agitated for independence and were instrumental in calling the Continental Congress. See REVOLUTIONARY WAR IN AMERICA.

SOPHOCLES, *sof′o ḳleez* (about 496-406 B. C.). Next to Aeschylus, the greatest writer of drama in Greece was Sophocles. He was responsible for the introduction of a third character on the stage instead of the customary two; he increased the size of the

SOPHOCLES, TRAGEDIAN OF ATHENS
His characters are human and lifelike, his style is lofty, and his viewpoint ethical.

chorus and improved the scenery. His plays are less heroic than those of Aeschylus, but the characters are more human and more easily understood by the modern world. The verse in which the plays were written is distinguished for its purity and dignity.

Sophocles was born in Colonus, a suburb of Athens. His first play, *Triptolemus,* won immediate success. During a long period he entered many competitions, even against Aeschylus and Euripides, and it is said he always won either first or second place. Sophocles also was a general, serving in the army against the aristocrats of Samos, and in the Peloponnesian War.

Only seven plays of more than a hundred which he is supposed to have written have come down to us. They are *Antigone, Electra, Trachiniae, Oedipus the King, Ajax, Philoctetes,* and *Oedipus at Colonus.*

SOR′GHUM. Not unlike corn in appearance, sorghum is believed to have originated in Africa and was grown in Egypt as early as 2200 B. C. It is still an important crop throughout India, China, and Africa, and is raised in the United States, especially in the dry prairie states.

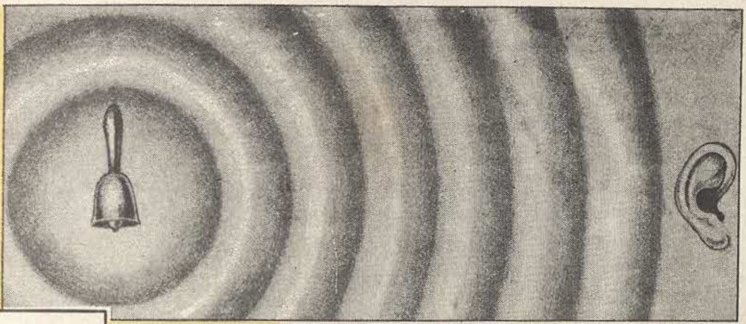
Like corn, sorghum is a member of the grass family. It differs, however, in its fruiting habits, bearing both the blossom and the seed in a terminal spike, placed similarly to the tassel on the corn plant. The various sorghums themselves differ widely in characteristics. The seed heads may be erect, recurved, loose, or compact. The color of the heads also varies, and in height the varieties range from three to eighteen feet. Sorghums prefer a hot, dry climate and thrive best on a clay or sandy loam, rich in humus.

The principal groups are the sweet sorghums, grain sorghums, grass sorghums, and broomcorns. The sweet sorghums are the source of syrup and are valuable fodder plants. Kaffir corn is an important type of grain sorghum (see KAFFIR CORN). The grass sorghums are useful principally as hay and pasture plants. The long, loose panicles, or heads, of the broomcorns are used in the manufacture of brooms.

SOROR′ITIES. Consisting of women students bound together by membership in a common organization, sororities are a counterpart of the men's fraternities found in the colleges and universities of America. Sororities assist in adjusting women to college life and also provide a means whereby women may participate in the social life of the school. Most sororities are secret societies; that is, their rituals and ceremonies are kept from the knowledge of outsiders and their meetings are limited to members of the group.

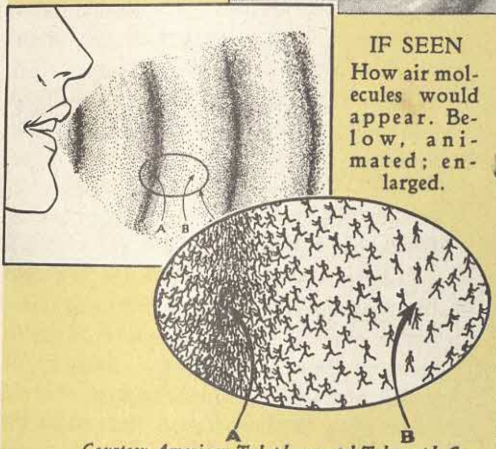
Many sororities are of nation-wide scope, each having branches or chapters at various schools, but no sorority has more than one chapter at any one college. The two oldest sororities in America are *Kappa Alpha Theta,* founded at De Pauw University, and *Kappa Kappa Gamma,* organized at Monmouth College. Both were founded in 1870. See FRATERNITIES, COLLEGE.

SOR′REL. Grown in Europe for use as an herb and in salads, the sorrel, a member of the buckwheat family, grows to a height of two feet and has sour, juicy, arrow-shaped leaves. In America the *common* sorrel is smaller and bears white, yellow, and pink flowers. Other common species of the herb are *sheep* sorrel, which has widespreading roots; *Indian* sorrel, used in the tropics in jellies and drinks; and *mountain, switch,* and *water* sorrel.



THE UNSEEN TIDE OF SOUND

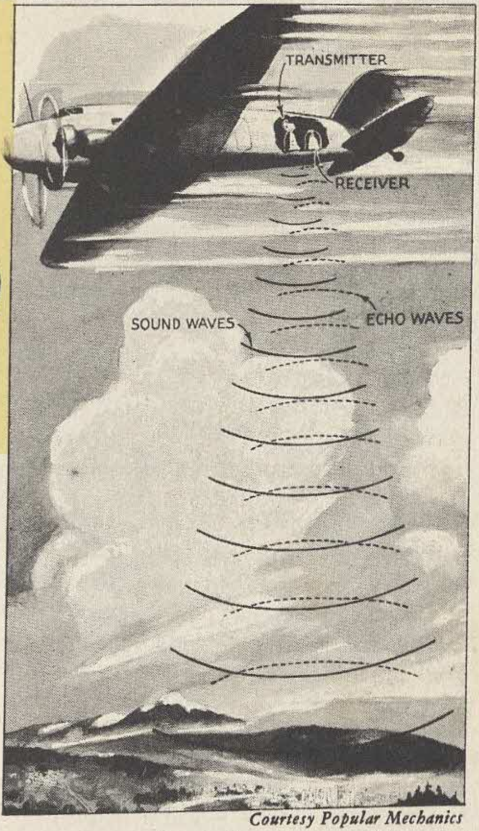
Vibrating bodies emit waves which reach our ears, producing sensations of sound. Despite fogs, fliers can accurately compute the plane's altitude by "timing" the return of the sound waves from the ground (right, below).



IF SEEN

How air molecules would appear. Below, animated; enlarged.

Courtesy American Telephone and Telegraph Co.



Courtesy Popular Mechanics

SOUND. Any of the various sounds which we hear may be traced ultimately to some body, the particles of which are in rapid vibration. A violin string when giving out a sound is seen to be somewhat hazy in outline, and the outline becomes perfectly definite when the sound dies away. A small piece of paper doubled and placed on the string (which is giving forth a sound) immediately recoils. The hand placed on a sounding bell can feel a movement which ceases, however, as soon as the hand touches the bell.

Vibrations from these bodies set up vibrations in the air which strike upon the ear and give the sensation of sound. Water and solid bodies will transmit these vibrations just as well as the air will. Holding the ear to the steel rail, one can hear the rumble of an approaching train long before it could be heard through the air. Sounds travel in air at a rate of about 1,100 feet per second, the velocity becoming correspondingly faster as temperature rises.

Loudness. As air is compressed it transmits sound much more readily and the sound appears louder. This loudness or intensity of sound becomes more faint the farther one is from the sounding body. If the distance is doubled, the sound becomes four times as faint. If the distance is three times as great, the sound is nine times as faint. In each case the intensity of the sound varies inversely as the square of the distance.

Pitch and Range. The pitch of sound or the highness of key depends on the number of vibrations per second sent out by the body. The more vibrations per second, the higher is the note. About fifteen beats or vibrations per second is the lowest number which can be detected as a sound. A vibration of 20,000 per second is about the upper limit which is recognizable as sound. The piano has a range of from 40 to 4,000 vibrations per second.

Sound Transmission. A message or sound is transmitted by telephone lines when the speaker's voice causes a diaphragm, or movable plate, to vibrate. This vibration causes a change in the strength of the electric current in the telephone circuit in such a way as to operate magnetically another similar diaphragm at the other end of the telephone line. The vibration of this second plate gives to the ear of the receiver of the message the same sound as that which caused the sound in the first place, and the receiver of the message hears the voice of the speaker miles away.

Sounding Board. In churches or concert halls, sounding boards are used to cause the vibrations to be directed so as to be heard distinctly. The human vocal system is provided with a sounding board in the upper portion of the mouth to which vibrations are directed when the singer wishes to reinforce the tone and make his tones resonant. The bones in the upper part of the face respond to the vibrations of the vocal cords and make these louder and fuller, amplifying the tone.

Amplifiers are used in radio telephony to make louder the sounds of the speaker's voice when these sounds are transmitted by wireless to distant audiences.

Consult the following articles for additional information:

- Acoustics
- Ear
- Echo
- Harmonics
- Light
- Lightning
- Music
- Physics
- Radio
- Waves

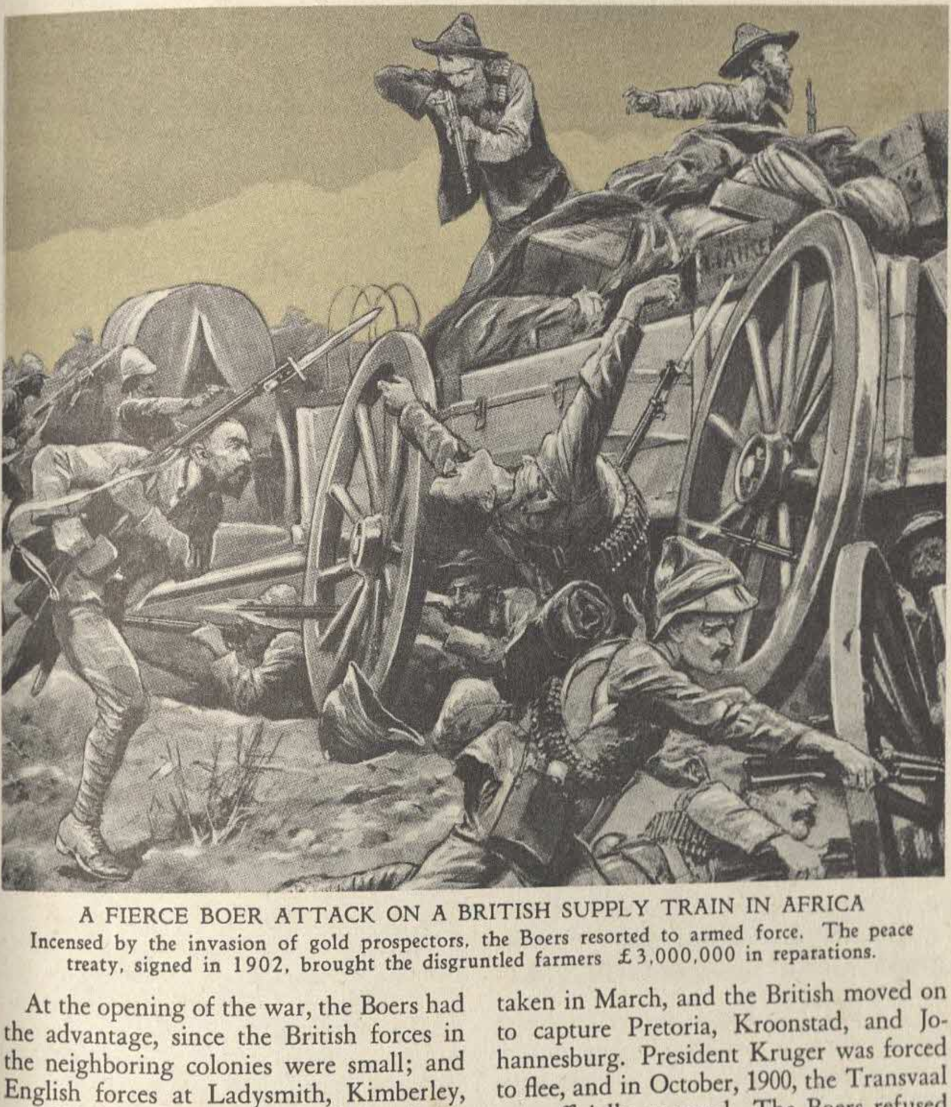
SOUND'ING. When sailors desire to know the depth and nature of the sea bottom, they take soundings. To find the depth, a lead plummet, which is attached to a measured line, is sunk. The nature of the bottom, as roughness or smoothness, is ascertained by noting the differences in depth at various points. In navigation, two such plummets are used—the hand lead, weighing from seven to fourteen pounds, for shallow water; and the deep-sea lead, weighing from 40 to 100 pounds, used in deeper waters. To discover whether the bottom is sandy or rocky, tallow is sometimes applied to the bottom of the plummet.

For scientific investigations of the sea floor, much more complicated equipment is employed.

SOUTH AFRICA, UNION OF. See UNION OF SOUTH AFRICA.

SOUTH AFRICAN WAR (1899-1902). Waged between England and the two Boer republics of South Africa—the Transvaal and the Orange Free State—the South African, or Boer, War gave England a vast and rich section of the African continent and made her the principal power in South Africa. The Boers, who were of Dutch extraction, had settled in Africa in the early part of the nineteenth century. With the discovery of gold in Witwatersrand (in the Transvaal) in 1886, foreigners, especially from England, poured into their lands until they far outnumbered the Dutch.

The Boers feared that these Uitlanders (Outlanders) might seize control of the government, and so, under the leadership of President Paul Kruger, they began to place many restrictions on the foreigners and refused them any representation in the government. The foreigners objected, and the situation grew more serious, until Jameson's Raid, in December, 1895, brought matters to a head. Although the British punished the man responsible for the raid, the Boers used the incident to place further restrictions on foreigners. This policy led England to send soldiers to protect British interests. In 1897 the two Boer republics, the Transvaal and the Orange Free State, had entered into an alliance, and in October, 1899, they declared war.



A FIERCE BOER ATTACK ON A BRITISH SUPPLY TRAIN IN AFRICA
Incensed by the invasion of gold prospectors, the Boers resorted to armed force. The peace treaty, signed in 1902, brought the disgruntled farmers £3,000,000 in reparations.

At the opening of the war, the Boers had the advantage, since the British forces in the neighboring colonies were small; and English forces at Ladysmith, Kimberley, and Mafeking were hemmed in. Reinforcements were sent under Sir Redvers Buller, but failed to check the Boers. In January, 1900, Lord Roberts arrived to take command, with volunteer troops, and with Lord Kitchener as his chief of staff. Kitchener later succeeded Roberts as chief commander.

By the end of February the British had relieved Ladysmith and Kimberley, and the tide turned to the British. Bloemfontein, capital of the Orange Free State, was taken in March, and the British moved on to capture Pretoria, Kroonstad, and Johannesburg. President Kruger was forced to flee, and in October, 1900, the Transvaal was officially annexed. The Boers refused to make peace and continued to carry on guerrilla warfare under the leadership of De Wet and Botha; but in March, 1902, they were ready to enter a peace conference, and on May 31 a peace treaty was signed.

Under the treaty all Boers were to cease fighting and proclaim their allegiance to the English king; all prisoners were to be returned to their homes; no action was to be taken against the Boers for legitimate acts of war; use of the Dutch language was to be permitted in the schools and courts; the military government was to be replaced by a civil government as quickly as possible; and farmers were to be paid for destruction of their farms by the British.

During the war 4,000 Boers were killed, and 5,774 British. See UNION OF SOUTH AFRICA.

South America

LAND OF GAUCHOS
Cattle raising is an important part of America's economy. In some countries, the cowboys are called *llaneros,* and in other places, *gauchos.*

Pan American World Airways

SOUTH AMERICA. Joined to North America by the slender Isthmus of Panama, South America is the fourth largest continent. Its eastern coast is washed by the waters of the Atlantic, its western by the Pacific. Between its northern coast and North America lie the Caribbean Sea and the Gulf of Mexico.

South America's vast triangular area contains over 6,850,000 square miles (slightly more than seven eighths that of its somewhat similarly shaped northern neighbor) and an approximate one seventh of the world's total land area. It lies in a southeasterly direction from North America,

Courtesy Furness Lines

ONE OF THE CONTINENT'S BROAD WATER HIGHWAYS TO THE SEA

Typical of South America is this busy river scene. Most of Brazil's rubber and forest products are conveyed to central gathering points by small sailing vessels.

most of it being below the equator. Its greatest length is about 4,800 miles; its greatest width, about 3,300 miles.

Coast Line. With the possible exception of Africa, South America has the world's most regular coast line. For this reason, good harbors are few. The Gulf of Darien, the mouth of the Amazon, the port of Rio de Janeiro, the mouth of the Plata, Bahia Blanca, the Gulf of San Matias, and the Gulf of Saint George are the most important Atlantic indentations; along the Pacific the only important indentations are the Gulf of Guayaquil and the rugged southern Chilean coast. The only islands of importance are Trinidad, off the northeast coast; the Falkland Islands, east of the Strait of Magellan; and the Galapagos, off the coast of Ecuador.

Surface and Drainage. Greatest among South America's mountain systems are the Andes, striding along the western coast from the Isthmus of Panama to Cape Horn, a chain second only to the Himalayas in height. The highest peak is Mount Aconcagua (about 23,000 feet), and several lesser peaks are active volcanoes. Second in importance are the Brazilian Highlands, a broad range of less than half the height of the Andes. The third group comprises the highlands of Guiana, lying in the northeast and separating the Amazon and Orinoco valleys.

The remainder of the continent may be divided into five regions: (1) the low coastal plains lying between the Andes and the Pacific; (2) the Orinoco Basin of treeless plains, or *llanos,* affording fine pasturage between the dry and the rainy seasons, and reverting to virtual desert in the dry season; (3) the Amazon Basin, a jungle area of more than 2,000,000 square miles; (4) the dry plains, or *pampas,* of Northern Argentina, most of which are covered with tall grass, forming the great cattle country of the continent; (5) Southeastern Brazil, heavily forested along the coast and opening into broad pastures in the interior.

Three of South America's largest rivers empty into the Atlantic. The Amazon, the largest river system in the world, drains over one third of the continent and flows northeast into the Atlantic. The Orinoco, which drains much of the northern part of South America, also flows northeastward. The Plata drains Northern Argentina, Uruguay, and Paraguay. The Paraná flows into the Plata. Less important rivers are the Magdalena of Colombia, the São Francisco of Brazil, and the Rio Negro and the Rio Colorado of Argentina.

Largest of the lakes is Titicaca in the Andes, with an area of about 3,500 square miles. Lying at an altitude of more than

Courtesy Pan-American Airways

DIVERSIFIED INDUSTRY

(1) Hardy gauchos of the Argentine pampas. (2) Indian sailboat of rushes used on Lake Titicaca. (3) Sugar cane is British Guiana's most important crop; forms about three fifths of her export. (4) Heavy loads are carried to market by head or burro.

12,000 feet, it is the highest navigable lake in the world.

A Wealth of Minerals. Ever since the early colonization of America by the Spaniards, the Andes have continued to yield vast stores of silver. Gold, copper, and nitrate are also found in abundance. Other commercially important minerals of South America are diamonds, emeralds, coal, iron, tin, nickel, and petroleum.

Climate and Vegetation. South America does not have the extremes of temperature that exist in North America. Many of the Andean peaks, even on the equator, are perpetually snow-capped. The climate of the northern countries, although hot, is somewhat tempered by highlands. Throughout the low Amazon and Orinoco valleys, however, the heat is insufferable, and the same conditions prevail along the Brazilian coast. In the Amazon regions the rainfall is extremely heavy, in some places amounting to 200 inches a year; it gradually lessens to the south until the arid Patagonian area is reached. In the extreme southern tip of the continent there are but slight temperature variations because of the mountain and ocean influences. The seasons are the exact opposite of those in North America, summer coming in December, January, and February, and winter in June, July, and August.

The variety of vegetation on the continent is amazing. In the Amazon valley there thrives an almost impenetrable mass of tropical trees, including ebony, mahogany, dyewoods, cedars, and numerous species of ferns. Here also the cannonball tree and Brazil-nut tree grow in profusion. Further south stretch the famous beech forests of Argentina and the araucarias of Chile. The cinchona, a tropical tree of medicinal value, is of special interest. Both pampas and llanos are covered with a rank growth of heavy grass during the wet season.

Animal Life. Both the alpaca and the llama are used for their wool and as beasts of burden. The most dangerous animal on the continent is the jaguar. Bears, snakes, and alligators are all found in the sultry regions of the Amazon. The tapir, tribes of chattering monkeys, flocks of brilliantly colored birds, sloths, lizards, and swarms of bright butterflies and nagging insects make the torrid areas interesting, but by no means attractive.

Industries and Products. Industries are developing rapidly in South America, but grazing, farming, and mining remain most important. Herds of cattle are raised on both the pampas of the south and the llanos of the north. The finest farming areas lie in southeastern Brazil where coffee is the outstanding crop, and along the Plata River, South America's great grain belt, where wheat, corn, flax, barley, and cotton are cultivated. Many of the torrid regions produce sugar cane, cacao, cassava, tobacco, and rubber. Chief among the continent's exports are rubber, wheat, wool, hides, meat, coffee, and nitrate of soda, or Chile saltpeter.

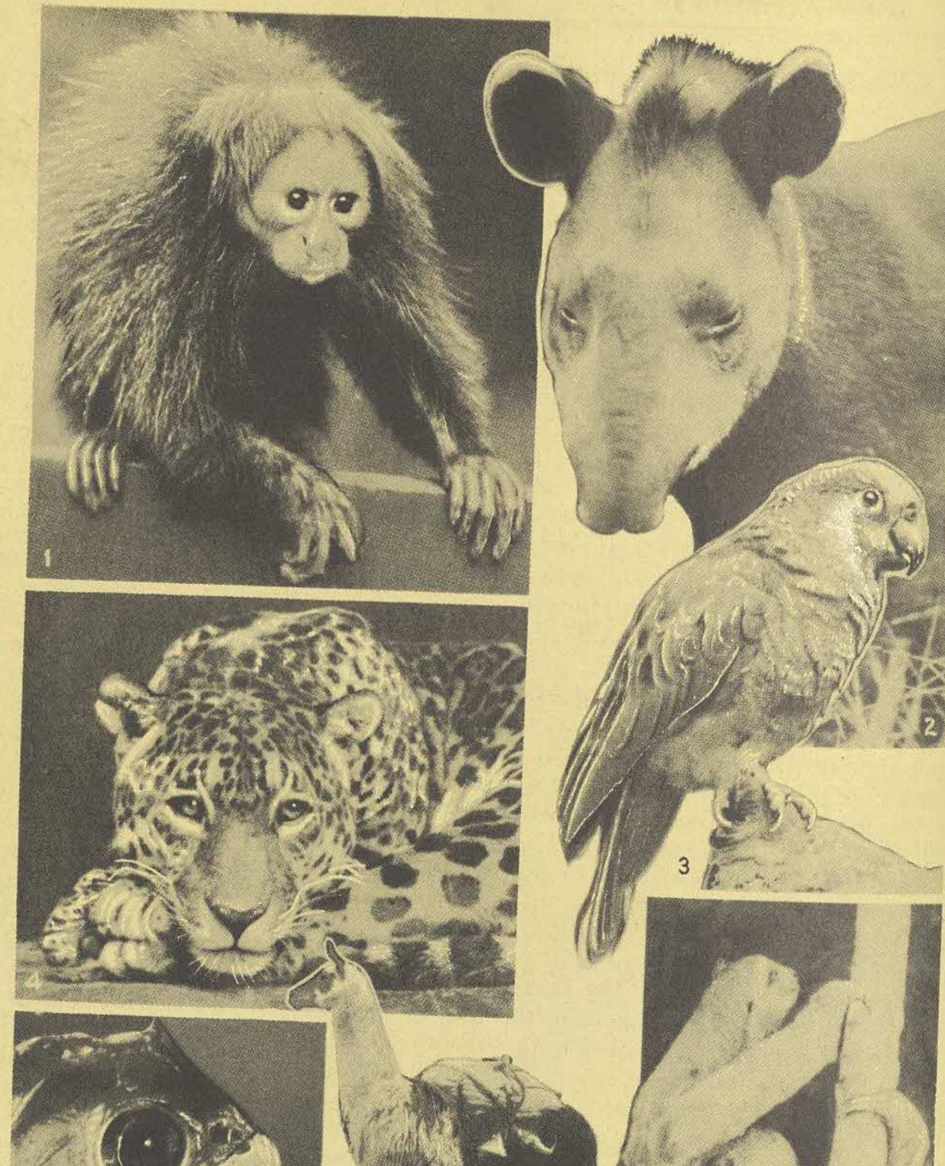
Transportation. In many parts of South America the construction of railroads and improved highways advances steadily. Moreover, many of the rivers of South America are important means of transportation. Air service from North America serves the important cities on both coasts.

People. The original inhabitants of the continent were Indians. In general, South America is sparsely inhabited, the greatest density occurring along the coasts. Many of the present inhabitants are mestizos of mixed Indian and Spanish or Indian and Portuguese blood, the remainder of the populace being composed largely of Spanish, Italian, and German immigrants. Spanish is the official language of all the independent countries, with the exception of Brazil, where the language is Portuguese.

History. Columbus was the first white man to set foot on South American soil, touching near the mouth of the Orinoco on his third voyage in 1498. He was followed by a Spaniard, Alonso de Ojeda, who explored the northeastern coast. The account of this voyage was recorded by Americus Vespucius, for whom both continents of the New World were named. The Portuguese, too, explored and claimed land in South America. The continent remained in the hands of Spain and Portugal until the beginning of the nineteenth century.

The Spanish colonies broke away in 1810, and, after several years of conflict, a number of republics were established. Brazil, the only Portuguese colony, followed suit in 1822, setting up a monarchy which lasted until 1889, when the country became a republic. British, French, and Dutch Guiana are now the only foreign-owned territories on the mainland.

Only one country, Brazil, actually entered World War I against Germany, although Argentina was dangerously near the step. Argentina did, however, remain neutral, as did most of the other South



SOUTH AMERICA'S CURIOUS ANIMAL KINGDOM

(1) Scarecrow of the monkey family is this bright-eyed resident of the Amazon jungles. (2) The nearest approach to the elephant is the tapir. (3) The chattering parrot, relative of the cockatoo. (4) Jaguar. (5) The voracious, toothed piranha. (6) The Andean llama. (7) Three-toed sloth.

American countries. The South American countries sided with the Allies in World War II, and became members of the United Nations in 1945. South American countries co-operate with the nations of Central America through the Pan American Union on problems of common interest.

Consult the following articles for additional information:

POLITICAL ORGANIZATIONS

Argentina
Bolivia
Brazil
British Guiana
Chile
Colombia
Ecuador
French Guiana
Pan American Union
Paraguay
Peru
Surinam
Uruguay
Venezuela

GEOGRAPHY

Amazon
Andes
Falkland Islands
Galapagos
Juan Fernandez Islands
Orinoco
Paraná
Rio de la Plata
Tierra del Fuego
Trinidad

SOUTH CAROLI'NA. One of the thirteen original states, South Carolina is a land of contrasting beauty, ranging from swampy lowlands to dense pine forests and mountainous regions. Its semi-tropical vegetation has given it the name "Palmetto State." It is bounded on the north and northeast by North Carolina, on the east by the Atlantic Ocean, and on the west and southwest by Georgia. Its area is 31,055 square miles, making it fortieth in rank among the states.

The Land and Its Features. South Carolina may be divided into three geographic regions. The first is the "low country"—the coastal region, marshy and of irregular width. The second division is the "middle country," rolling and hilly; the western part is bordered with a chain of sand hills partly covered with pine forests. This section rises to the Piedmont Plateau. The "up country" is the third division and includes the western and northwestern parts of the state. The Blue Ridge Mountains are in the northwest. The principal rivers include the Savannah, Santee, Great Pee Dee, and Edisto.

Charleston Chamber of Commerce

THE CORNER OF THE FOUR LAWS

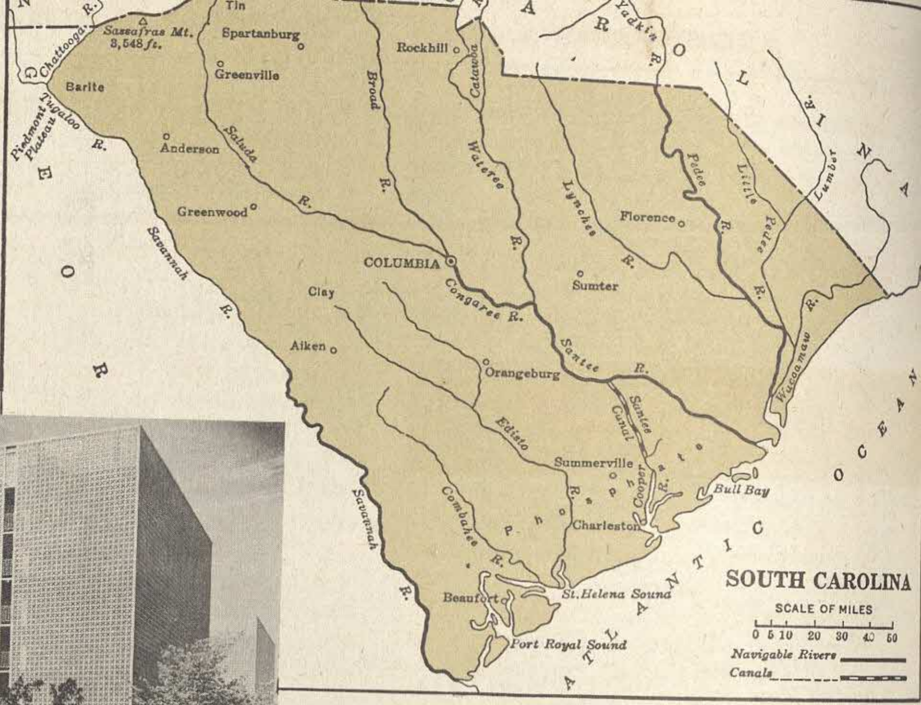
The Meeting and Broad Street intersection in Charleston, S.C., is occupied by the post office and Federal court, the county courthouse, the city hall and St. Michael's church, representing the laws of God, nation, state and city.

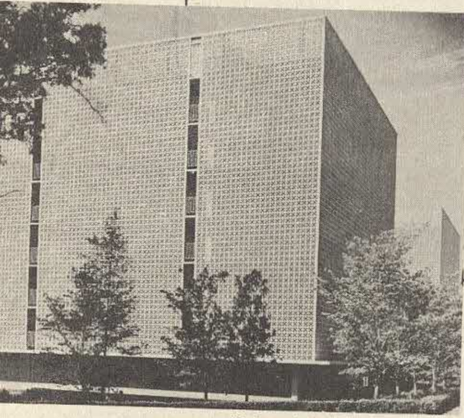
Climate. The climate of South Carolina is mild and pleasant. Usually snow falls only in the mountains, and winters are short in all parts of the state. The western part of the state is subject to tornadoes, and the coast to hurricanes. The average rainfall is about forty-eight inches and the average annual temperature about 63° F.

Natural Resources. Although the mineral resources of South Carolina are known to be rich, they have not been fully exploited. The most important deposits are kaolin, marble, granite, white clay, and limestone. Other deposits include phosphate rock, mica, iron, gold, silver, manganese, and monazite.

Large supplies of pine, cypress, and other valuable commercial timbers come from the state's mountain slopes, swamplands, and wood lots. Oysters are its most important ocean product, but its coastal waters also yield clams, crabs, shrimps, mussels, flounder, shad, mullet, terrapin, and other sea foods. Its fresh-water fish include trout, pike, and perch.

Farming. South Carolina has been predominantly an agricultural state since it was first settled. The leading crops are cotton, tobacco, corn, oats, and peanuts. Sweet and Irish potatoes, soybeans, sorghum, hay, melons, nursery plants, flower seeds, berries, vegetables, and fruits also are





University of South Carolina

THE OLD AND NEW AT U. OF S. C.
Men's residence halls at the University of South Carolina in Columbia, upper left, are striking in design. The concrete curtain wall of the building bears no weight, but is designed to provide ventilation and screen the sun's rays. The school's library, lower left, oldest separate college library building in the United States, was erected in 1840. Its portico fronts on the campus "horseshoe," enclosed by other buildings.

important. The principal fruits are peaches, pears, apples, cherries, plums, apricots, figs, nuts, and grapes. Livestock and poultry raising are also important.

Manufacturing and Commerce. South Carolina is particularly fortunate in possessing abundant water power. The rivers, rising in the mountains, become fast-running streams as they pass over the Fall Line between the Piedmont and coastal regions. South Carolina is one of the leading textile-producing states in the Union. The lumbering industry is second in importance. Other important industrial products include fertilizers, cottonseed oil, iron and steel products, food products, paper, chemicals, tobacco products, and canned goods.

The navigable rivers of the state provide some of the transportation facilities. There are also about 4,000 miles of railroads and 22,500 miles of highways. Charleston, on the Atlantic coast, is one of the chief ocean ports of the United States.

Government and Education. The governor of South Carolina is elected to a four-year term. The upper house of the legislature consists of forty-six members and the house of representatives of 124 members. The five justices of the supreme court, at the head of the judiciary, are appointed by

South Carolina Agriculture Dept.

COTTON, CAROLINA'S NO. 1 CROP
Experts discuss a bumper cotton yield raised on land alternately planted with fescue and clover.

the legislature for ten years. Columbia is the capital city, with a population of about 99,000.

The school system of South Carolina has been greatly improved in recent years. School attendance has been compulsory since 1922. The state provides separate schools for white and colored children. Among the institutions of higher learning are the University of South Carolina, Clemson Agricultural College, Furman University, the Citadel, and the Benedict College for Negroes.

History. The first settlement of South Carolina was attempted by the Spanish in 1526, but the settlement lasted only a few months. A group of French Huguenots attempted a settlement at Port Royal in 1562 but soon abandoned it. Another Spanish settlement was established in 1566, which endured for some twenty years. In 1663 Charles II, king of England, included what is now South Carolina in a grant of land to eight English proprietors. In 1670 the first permanent English settlement, Charleston, was established. The coastal land was settled by Huguenots.

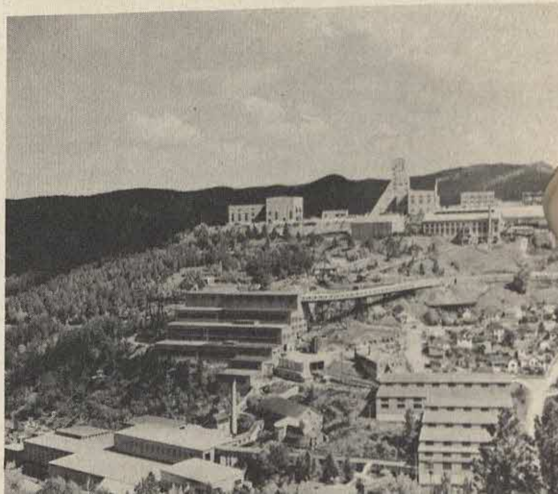
In the eighteenth century the interior lands were taken up by English, Scots, and Germans. A rapidly-developing plantation system of agriculture, devoted chiefly to the raising of rice and indigo, made it necessary to have cheap labor. For this reason, Negro slave labor was much in demand, and by 1700 there was a large slave population.

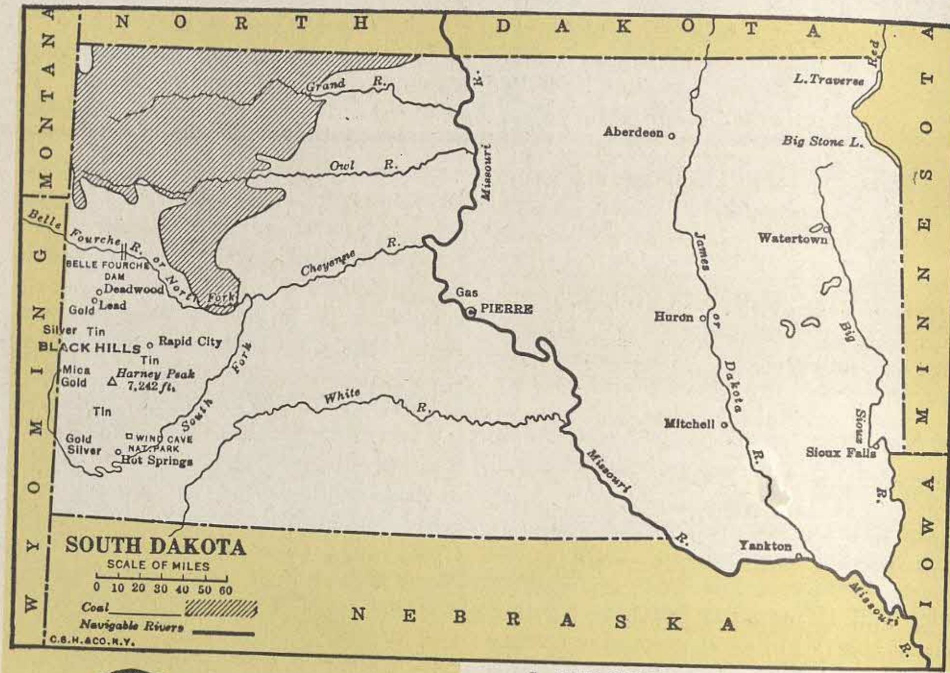
South Carolina took an active part in the Revolutionary War, and many important engagements were fought on its soil. The state was always anti-Federalist, fighting strongly for the preservation of slavery and Southern rights. It was the first to break away from the Union in 1860. Following the war, it suffered from corrupt carpetbag governments and was readmitted to the Union in 1868. The state has a present population of about 2,382,000. See CALHOUN, JOHN C.; COLUMBIA; CIVIL WAR IN AMERICA.

SOUTH DAKO'TA. In the north-central part of the United States, South Dakota is one of the great prairie states. Because of its many bright, sunny days, it is popularly called "the Sunshine State." South Dakota covers an area of 77,047 square miles. North Dakota lies to the north, Minnesota and Iowa to the east, Nebraska to the south, and Wyoming and Montana to the west. The population is about 684,000. The capital of the state is Pierre, and the largest cities are Sioux Falls, Aberdeen, Huron, Mitchell, Rapid City, Watertown, Lead, and Yankton.

Surface Features. South Dakota is divided into two almost equal parts, east and west, by the Missouri River, which flows

AMERICA'S LARGEST GOLD MINE
Opened at Lead, S.D., in 1877, the Homestake averages more than a half-million ounces a year.





A PARADISE FOR VACATIONERS

Nature did her best—and worst—in South Dakota. Well-stocked rivers and lakes, the Black Hills, Bad Lands, dense forests, all beckon the tourist. Left, gigantic stone likenesses of Washington and Jefferson at Mount Rushmore.

across the state in a southeasterly direction. The surface consists of gently-rolling prairie which slopes upward from the plain east of the Missouri, merging with a plateau in the western part of the state. In the east is the Prairie Coteau, which is separated from the Missouri Coteau by the valley of the James River.

The western part of the state has a rougher surface than the eastern, is much better drained, and is much higher. In the southwest are the Black Hills, a mountainous region about 125 miles long and sixty miles wide, with an average elevation of from 4,000 to 5,000 feet, although some peaks are much higher. In the Black Hills is Mount Rushmore, where the sculptor Gutzon Borglum has carved huge heads of Washington, Jefferson, Lincoln, and Theodore Roosevelt (see BORGLUM, GUTZON). Southeast of the Black Hills are the famous Bad Lands, so-called because the numerous gullies, ridges, and steep slopes caused by erosion make the region hard to cross.

The Missouri River is the main stream and drains nearly all South Dakota. Its principal tributaries are the Big Sioux, the James, the Moreau, the Grand, the Cheyenne, and the White rivers. The largest lakes are Big Stone Lake and Lake Traverse, both in the northeast corner of the state.

Climate. South Dakota has a continental climate characterized by hot summers and cold winters. Although there are extremes of temperature, the dryness of the air makes the climate bearable and healthful. The average annual rainfall varies from fourteen inches in the northwest to thirty inches in the southeast.

Natural Resources. South Dakota has a wide variety of minerals, found principally in the Black Hills. The great amount of gold mined there ranks South Dakota high among the gold-producing states. One of the largest gold mines in the world is located there. The Black Hills also contain copper, lead, silver, mica, tin, gypsum, tungsten, lignite, lithium, bentonite, feldspar, and other minerals. South Dakota also produces building stones, cement, and manganese ores.

Unlike the other plains states, South Dakota has large timber areas, located chiefly in the Black Hills. There are more than 1,000,000 acres of national forests in the state.

Farming in South Dakota. The level land with its rich soil produces large and varied crops. But like the other plains states, South Dakota periodically suffers dry years, in which farm production is greatly reduced. However, the state has always had a large production of grain. The most important crops are corn, wheat, oats, barley, potatoes, rye, and flaxseed, apples, pears, and other fruits. Livestock raising is also important.

Industries and Transportation. Most of South Dakota's manufactures are based on agriculture, the leading industries being meat packing, butter manufacture, flour milling, and printing and publishing. Other industries are railroad-car construction and repair, and lumbering.

In early days, boats, horses, stagecoaches, and ox-drawn wagons provided transportation in South Dakota. Today the state is served by railroads, airlines, and highways.

Government and Education. The governor of South Dakota and other state officials are elected for two-year terms. The legislature is composed of a senate of not less than twenty-five nor more than forty-five members, and a house of representatives of not less than seventy-five nor more than 135 members. A supreme court, elected by the people, heads the judiciary.

THE HOUSE THAT CORN DECORATES
The Corn Palace, in Mitchell, S.D., is decorated yearly inside and outside with thousands of bushels of corn arranged in designs. The Corn Palace Festival is held in September.

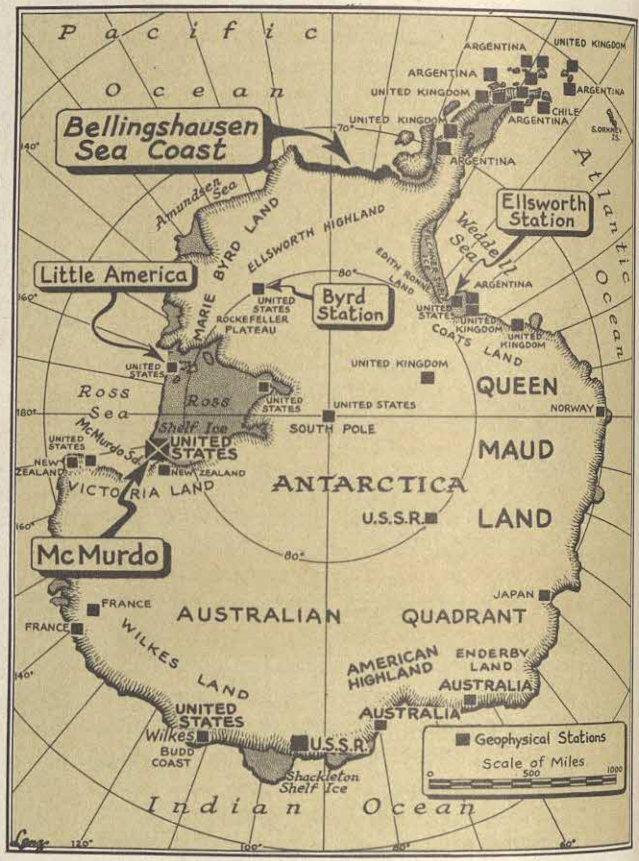
A state board of education administers the school system. The institutions of higher learning include the University of South Dakota, the South Dakota College of Agriculture and Mechanic Arts, the State School of Mines, four teachers' colleges, Dakota Wesleyan University, Huron College, and Yankton College. The Federal Government maintains several high schools for the state's Indians.

History. Although this region had been partially explored in 1804 by Lewis and Clark, the first permanent settlement was not made until 1817, when Joseph La Framboise built a fort near the present site of Pierre. It was the center of a fur-trading industry. In 1889 North and South Dakota, which had previously been known as Dakota Territory, were separated and admitted to the Union as two states. See PIERRE.

SOUTHERN CROSS. The Southern Cross is probably the most widely known constellation in the sky of the Southern Hemisphere. The four stars making up the cross differ widely in brilliance, only the lowest one being of the first magnitude. The northern and eastern stars are of the second magnitude, the western of the third. The upper and lower stars form an imaginary upright, pointing to the South Pole.

U.S. Coast Guard

Wide World



Russell H. Lenz, from the Christian Science Monitor

EXPLORERS AND SCIENTISTS STUDY THE ANTARCTIC

Powered by two propellers, the U.S. Coast Guard icebreaker "Eastwind," top left, smashed ice fifteen to twenty feet thick in McMurdo Sound, Antarctica, in order to deliver its cargo. The crushing weight of her bow permitted the ship to approach within four miles of the American base at Ross Island. Bottom, Sir Edmund Hillary, left, and Dr. Vivian Fuchs, center, leaders of British expeditions, conferred with U.S. Rear Admiral George Durek near the South Pole during Fuchs' attempt to span the Antarctic continent in 1958. Geophysical stations of many nations dotted the ice-covered expanse of Antarctica, above right, during International Geophysical Year, a project backed by 66 nations.

SOUTH POLAR EXPLORATION. A modern Norse explorer set sail for the Arctic Ocean and discovered, instead, the South Pole!

The discoverer was Captain Roald Amundsen, Norwegian explorer. In 1910 he started from Norway in the *Fram,* heading for Cape Horn, intent on sailing north in the Pacific to the Arctic. Instead, he kept southward past Cape Horn, camped on the Antarctic ice cap, and in October, 1911, began the historic trek to the Pole by sledge with four comrades. On December 14 the little band of explorers raised the Norwegian flag at the "bottom" of the earth.

While Amundsen was struggling toward the Pole, another explorer, Captain Robert

Official U.S. Navy Photo

ANTARCTIC ADVENTURER

Richard E. Byrd, master explorer of Antarctica

F. Scott, an Englishman, was approaching by another route. When Scott reached the Pole on January 18, 1912, he found the tent and the flag which Amundsen had planted but a month before. Returning to their base, all five of the Scott party died of exposure and exhaustion.

The first navigator known to have crossed the Antarctic Circle was Captain James Cook, who accomplished the feat on January 17, 1773. The next year, on January 30, 1774, he again crossed the Antarctic Circle and reached his southernmost point at 71° 10′ S. and 106° 54′ W. About the middle of the nineteenth century, several expeditions, French, American, and English, touched land at various points in Antarctica. Because the continent is still undefined, the lands discovered from time to time have been variously named Wilkes Land, South Victoria Land, King Edward VII Land, Wilhelm II Land, etc.

In 1909 Sir Ernest Shackleton, on one of his several voyages, reached a point less than 100 miles from the South Pole. That was the nearest to the Pole any explorer had been up to that time.

The earlier explorers used dogs and sleds in their Antarctic pioneering; but Admiral Richard E. Byrd, an American explorer, reached the South Pole by airplane. His expeditions of 1929, 1933, and 1939 brought back a vast fund of scientific information; and on his expedition of 1946-1947 he charted over 300,000 square miles and 3,000 miles of Antarctic coastline.

For further information, consult the following titles:

Amundsen, Roald
Antarctica
Byrd, Richard Evelyn
Cook, James
Ellsworth, Lincoln
Scott, Robert Falcon
Shackleton, Ernest Henry

SOUTH SEA COMPANY. Established in 1711, the South Sea Company was an English stock company which had been granted exclusive trading privileges in South America and the South Seas. The company grew enormously, and much money was invested. By 1720, confidence in the company weakened, and many people began to sell their shares. The company failed and the investors took a tremendous financial loss. An investigation showed the company to be fraudulent, and the property of the organization was seized. The sale of this property restored part of their investment to the stockholders. The venture is usually referred to as the *South Sea Bubble.*

SOVEREIGN, *suv′rin.* The gold coin which represents the English pound sterling is called a sovereign. It is eleven twelfths pure gold, with a weight of 123.274 grains troy, and bears a picture of the ruler. Since 1925, however, the issuing of all gold coins has been suspended. Under the gold standard the sovereign had a par value of $4.8665.

SOVEREIGNTY, *sov′ ur in ti.* See STATE.

SO′VIET. During the revolution of 1917, numerous soviets, that is, committees or local councils, were set up throughout Russia. They represented villages, factories, soldiers, etc. Each one was a democratic unit for governing a small group, but eventually the soviets became influential administrative bodies and formed a common federation, the All-Union Congress of Soviets. In 1936 the Congress was replaced by the Supreme Council of the Union of Soviet Socialist Republics. See RUSSIA; UNION OF SOVIET SOCIALIST REPUBLICS.

SOYBEAN. In value and extent of uses, the soybean is the most important legume grown in the Orient. It is used there as an important human food product in the preparation of a variety of dishes. Soy sauce and soybean sprouts are used in many dishes. In the United States the soybean is used chiefly for hay, green stock food, silage, and pasture. It is valuable to the horticulturist when plowed under as a green manure or as a soil rejuvenator. The soybean plant, since it is a legume, is a nitrogen-gatherer that can be used even in areas where clover will not survive.

The beans of the plant contain a valuable oil, and the meal cake obtained through the extraction of the oil is also a livestock feed, a meat substitute, a fertilizer, an ingredient in the making of plastics, and a medium for the production of the antibiotic called *bacitracin*. As a human food, the bean may be used as a green vegetable, or the dried bean may be cooked or used in the manufacture of milk and coffee substitutes. The high protein content of soybeans makes their products valuable for persons whose diet should be low in starch.

The numerous products containing soybean oil include salad oils, butter substitutes, explosives, lubricants, plastics, soap, glue, paint, varnish, printing ink, candles, linoleum, waterproof materials, and cattle feeds.

The plant is an erect annual that grows three to four feet tall. There are two distinct varieties—one smaller than the other. The larger variety is grown chiefly in southern Asia; the smaller is more popular in the United States. Soybeans were originally found in Asia and were introduced into the United States about 1804. However, not until the present century did soybeans become an important commercial crop.

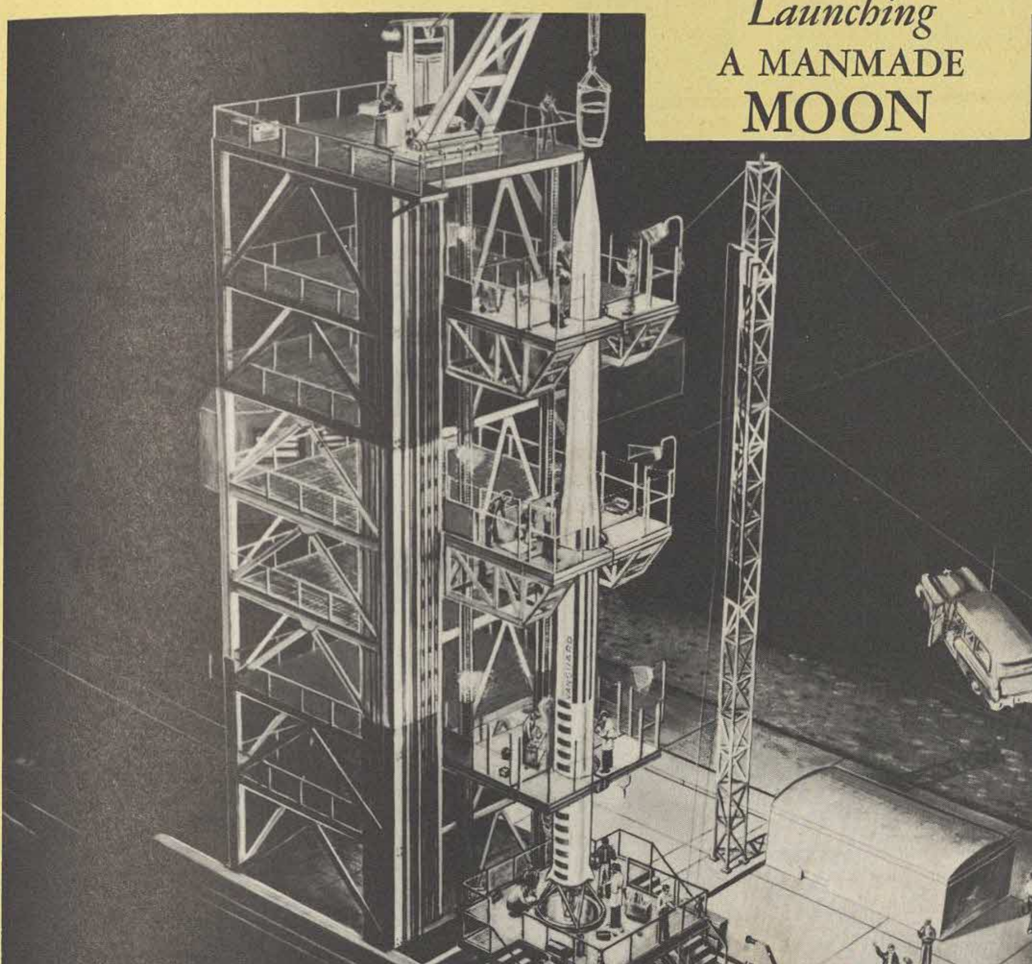
SPACE. The vast region beyond the atmosphere of our world we have named space, and it is indeed spacious. It extends for millions of light years in all directions. For the most part it is unknown and unexplored. In it are the planets, the galaxies, the stars, and an almost unimaginable number of smaller objects. On a clear night the great outer space may seem to be filled with celestial bodies. However, it is comparatively empty because millions of miles of open areas lie between the visible objects. In these areas there is an almost perfect vacuum, certainly one more nearly perfect than man has ever been able to produce. Yet within this vacuum there is some matter. There are particles of dust and gas from the breaking up of heavenly bodies, huge areas of radiation, ultraviolet rays from the sun, and cosmic rays made up of protons, alpha particles, and heavier nuclei. With giant radio telescopes, scientists have discovered that faint sounds can also be heard in far distant space.

Man has long dreamed of the challenge of exploring space, but not until the German V2 rockets of World War II was the first space engine successful. Since that time man has developed rockets that have shot satellites into the face of the moon; others that have been placed in orbit around the sun, the moon, and the earth; and still others that have passed beyond the sun and out of contact with the earth. In fact, so many satellites have been launched that scientists fear a situation of "space garbage" in which orbiting objects no longer valuable to scientific investigation will clutter space with the debris of their remnants or with transmitted sounds.

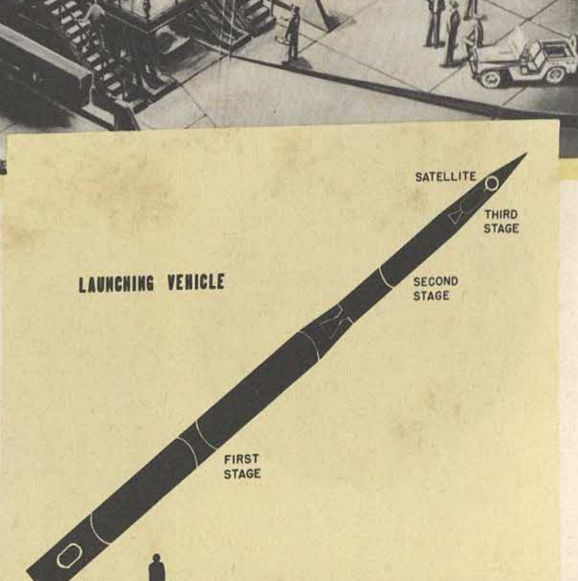
Most satellites contain instruments that report on the trip through space and help man increase his knowlege of the universe. Some never return to earth but others are designed for re-entry into the earth's atmosphere and are then recovered. Some of them have contained animals such as rats, monkeys, and dogs. The goal is to open the vast realms of space to exploration by manned space vehicles. In several nations

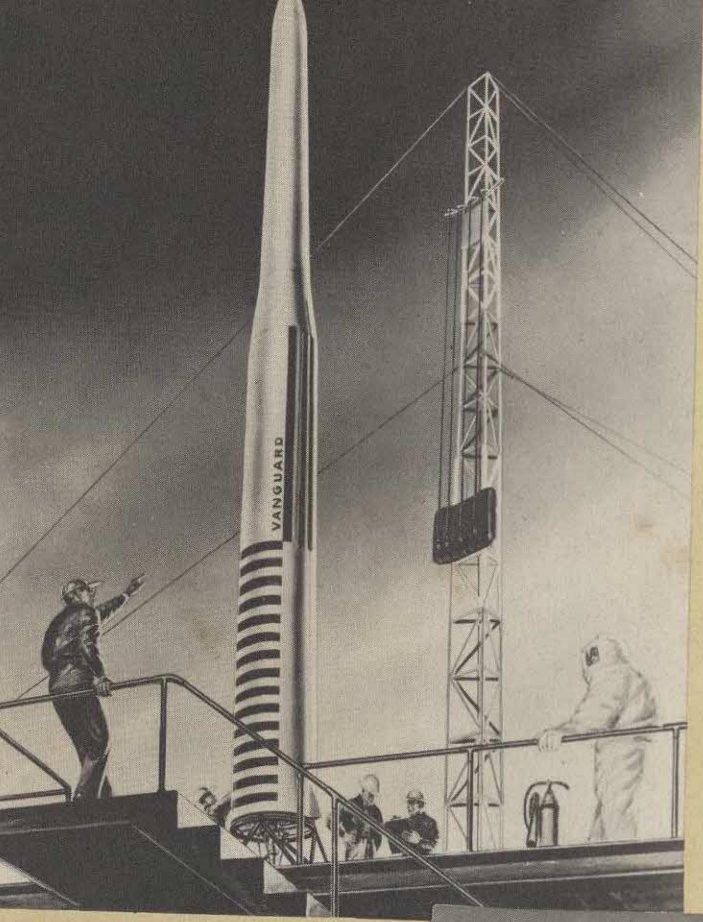
A WONDERLAND ADVENTURE··

Launching A MANMADE MOON



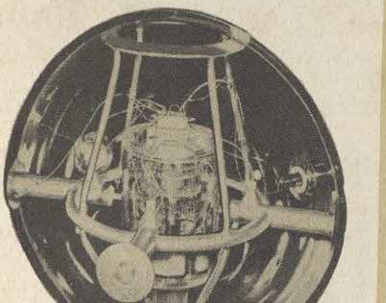
DESTINATION—SPACE. Preparing the giant launching vehicle for its long journey.





FUELING THE LAUNCHING VEHICLE. An asbestos-clad fire fighter stands ready to put out an accidental fire as a hydrogen peroxide tank (right) is hoisted into the rocket.

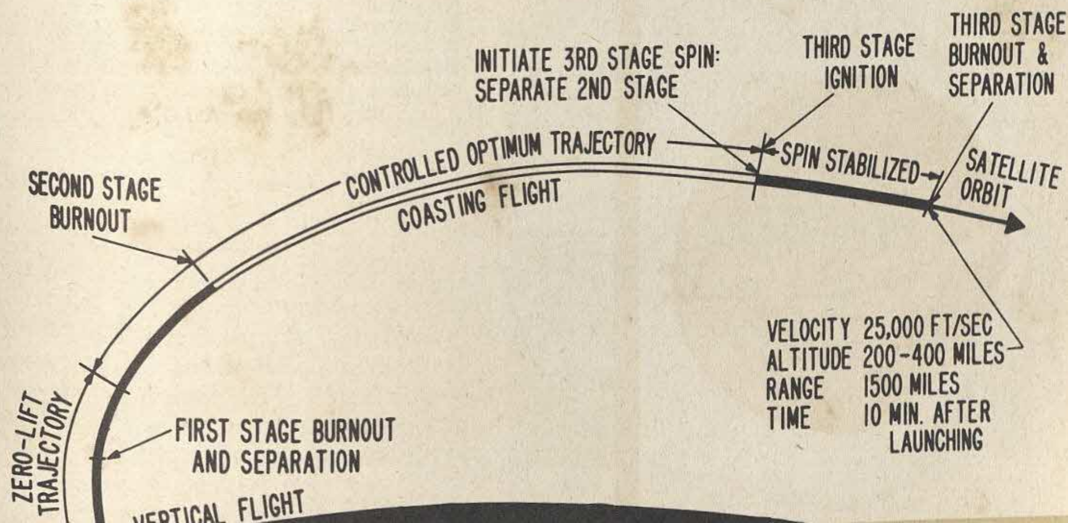
". . . THREE, TWO, ONE, ZERO!" The vehicle blasts off with a deafening roar.

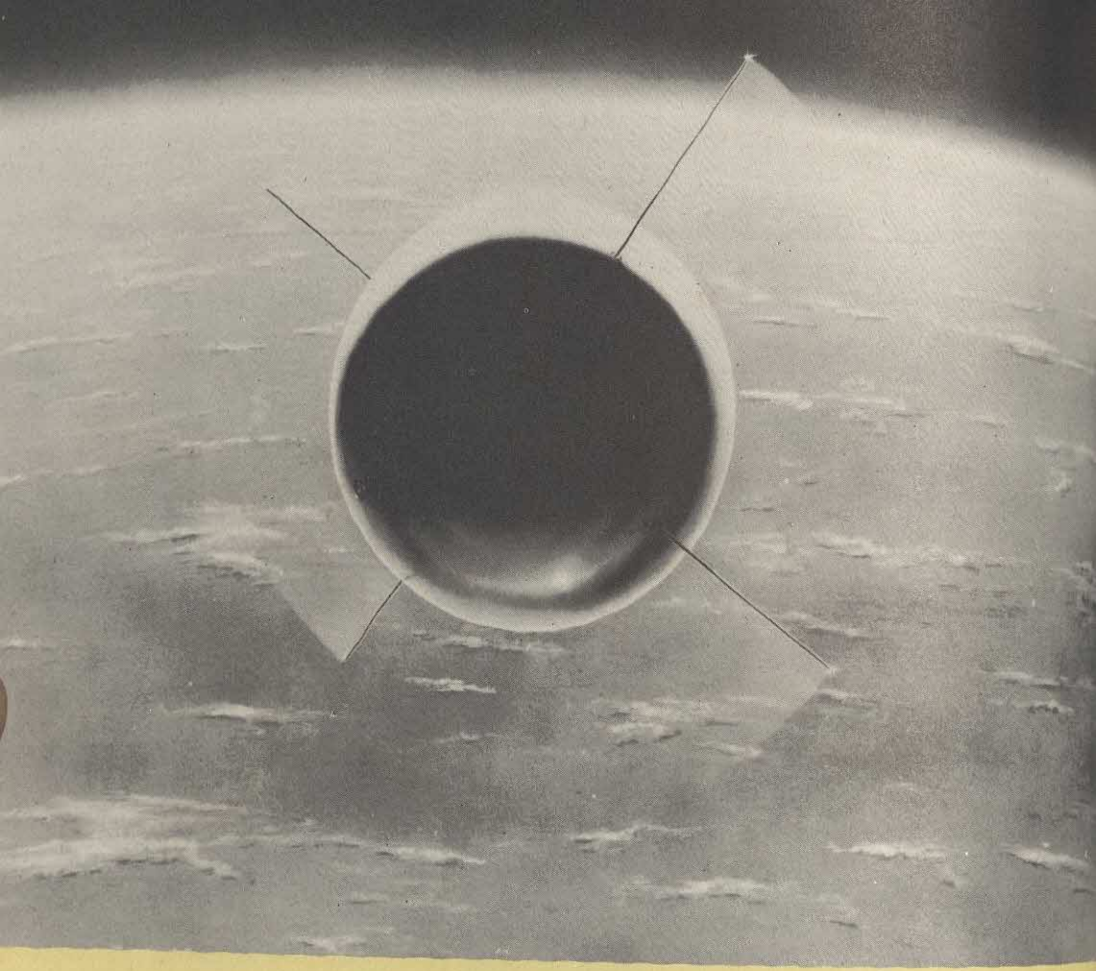


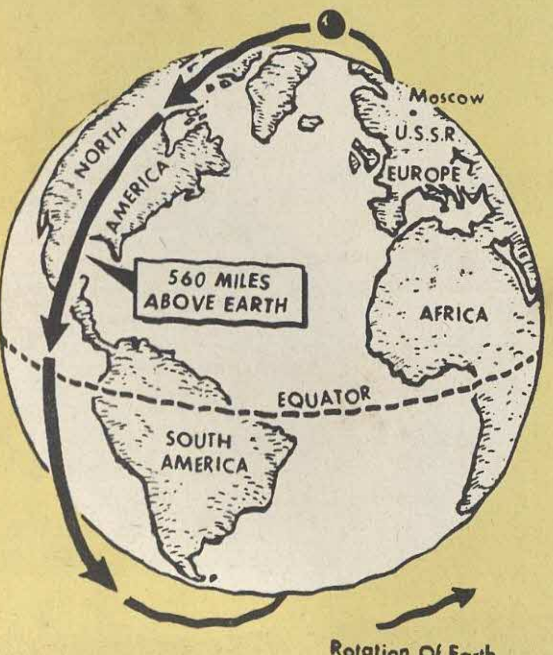
INSIDE THE SATELLI

THE PATH INTO SPACE. The first stage rocket drives the vehicle straight up through the dense lower atmosphere. Then it drops into the sea, ridding the vehicle of its weight. The second stage boosts the speed and altitude of the vehicle. It also steers it into a course parallel with the earth. During its flight, the nose cap, which protected the satellite from friction heat in the lower atmosphere, flies off. Before dropping off, the second stage spins the third stage. The spin stabilizes the rocket, just as spin stabilizes a rifle bullet. Finally, the third stage rams the moonlet forward at 18,000 miles an hour.

TWO MINUTES AFTER BLAST-OFF, the vehicle is thirty-six miles high and traveling at 4,000 m.p.h.

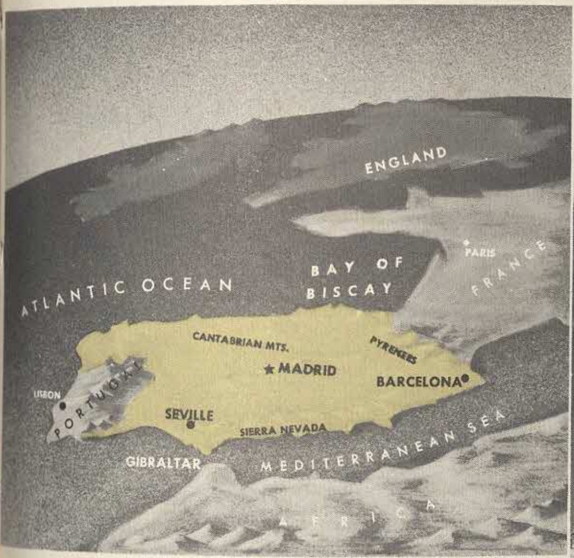






YEAR I OF THE SPACE ERA BEGINS. The first manmade heavenly body speeds around the earth. To scientists all over the world, its tiny radio transmitter has become the most important of all broadcasting stations. What they learn from it helps them solve many mysteries about the earth and its surroundings. The tiny space scout will be followed by ever larger and more efficient space ships. But none will be more important than the midget pioneer until man himself ventures into space.

there are men, called astronauts in the United States, who are especially trained to use the equipment and to experience some of the hazards of space flight. They use especially designed clothing; test instruments; experience a variety of physical and emotional responses to such sensations as weightlessness and turbulence; and try out various means of sanitation and sources of food. On the basis of their findings of human endurance, the various materials of construction, and the progress of technological applications of physics, man has prepared for space exploration.



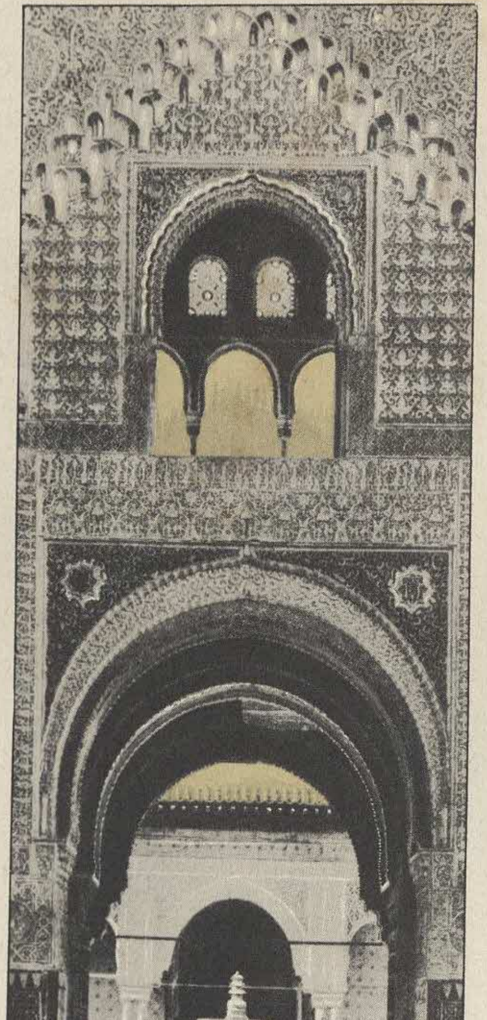
SPAIN. Beauty and blood, romance and cruelty, feudal tradition and modern advancement walk hand in hand in Spain, an unhappy problem child in Europe's family of nations. To tourists, it is sunny Spain, the land of picturesque cathedrals and palaces, of beautiful dancing girls and bold toreadors. To historians, it is the remnant of a world empire. Spain was a monarchy until 1931, when Alfonso XIII went into exile. A republic was then organized, but in 1936 a revolt of the conservatives under Francisco Franco started a civil war. In March, 1939, the Republican government fell, and Spain became a Fascist state.

Surface Features. Occupying most of the Iberian Peninsula, the land of Spain is typical of the contrasts found in its people, its life, and its history. The lofty Pyrenees form a natural land boundary on the north, and the Bay of Biscay forms the remainder of the northern limits of the country. On the west are the Atlantic Ocean and Portu-

Burton Holmes from Ewing Galloway, N. Y.

CASTLE IN SPAIN

Turreted Alcazar Castle stands guard over the ancient walled town of Segovia.



WHERE MOORISH CHIEFS HELD SWAY
Exquisite example of the superb art of Moslem architects, the Alhambra at Granada has long been a Spanish show place. This doorway to the Court of Lions is beautifully wrought with intricate and minute geometric designs.

gal. The south and east shores face the Mediterranean Sea. At the extreme southern tip is the mighty rock of Gibraltar which lies just a few miles away from the vast African continent. Altogether the mainland occupies 193,000 square miles; and with the Balearic and Canary islands, the entire country totals 196,607 square miles.

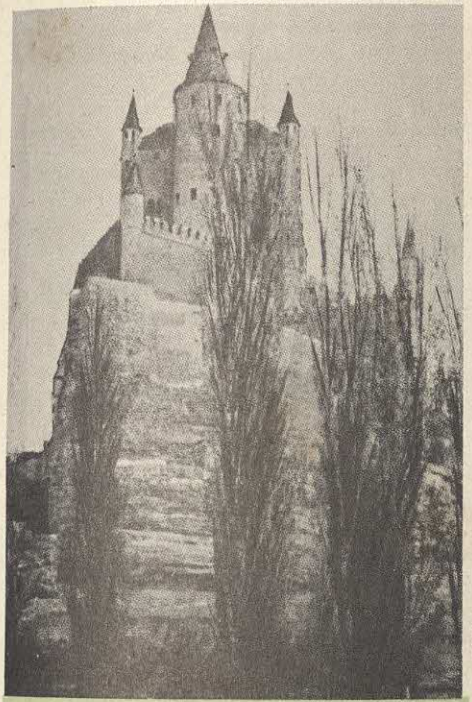
Much of the mainland is a high, treeless plateau from which rise a number of east-west mountain ranges. These ranges, called *sierras,* are lofty in some cases, the highest being the Sierra Nevada ridge in the southern portion. There are few rivers of importance, and all the main streams but one flow into the Atlantic. The only large river flowing into the Mediterranean is the Ebro, which drains the northeastern part of the country.

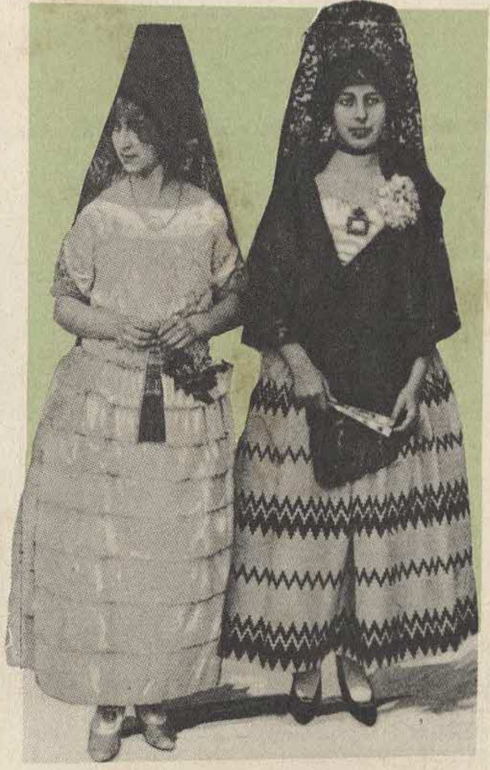
The plateau and the mountains give Spain a variable climate. Winter in the central portion is cold, and summer in the same area is very hot. In the southern part of the peninsula the climate is usually mild. The northern coast is mountainous and has a temperate climate.

An Unusual People. As variable and as changeable as the topography and climate are the people. Usually dark-skinned and of medium height, the Spaniards are a proud, brave people. They love pomp, splendor, and decoration and will fight against odds to the last ditch. They are personally dignified, courteous, witty, and violent in their loves and hates.

Invasions by Moors, Romans, and Teutonic tribes have had some effect on the Iberian physical characteristics of the people. The population of the land is comparatively small, being only somewhat more than 30,000,000. The largest cities are Madrid, the capital, and Barcelona. The population of Madrid is about 1,868,000. Valencia, Seville, and Malaga follow.

In 1901 it was estimated that sixty-six per cent of the people of Spain could neither read nor write, but reforms in education have reduced the illiteracy rate to about twenty per cent.





THE ROMANCE THAT IS SPAIN

Above, an old Spanish citadel looks down from its rocky height upon peaceful agricultural valleys. At right are pictured the traditional costumes of Spanish women who have clung, religiously, to their graceful mantillas, lovely shawls, and picturesque headdress.

Spain has always been a Roman Catholic country. Under the Constitution of 1931, Church and state were separated, but the Fascists restored the Church properties and removed restrictions on the clergy.

In literature and the arts, Spain has had a prominent place in the world. The earliest of the folk ballads is the poem celebrating the exploits of the Cid; fiction had its beginnings with the *Amadis de Gaula* in the fourteenth or fifteenth century. From the middle of the sixteenth to the middle of the seventeenth century, Spain experienced her Golden Age in literature, which was climaxed by the writings of Saavedra Cervantes. Creative literature declined in the eighteenth century, along with the political power, and most of the writers and dramatists imitated the French. In the latter years of the nineteenth century and in recent years, literature has again flourished in Spain.

Spanish music and painting also have been important in the world. The music is particularly rhythmic, suited to the dance. The great paintings are noted for brilliant coloring and religious significance. Spanish architecture shows the influence of the Moors; in some cities there are Gothic cathedrals and ruins of Roman aqueducts and bridges.

Natural Wealth and Industry. Spain is immensely rich in natural resources. There are large deposits of lead, copper, mercury, iron, coal, silver, salt, cobalt, zinc, manganese, sulphur, and phosphorus. Some of these deposits are mined by the government or foreign companies, but most of them have as yet been undeveloped. Their existence is one of the reasons for the interest of foreign powers in the affairs of Spain.

By far the greatest industry in Spain is agriculture, but its development has been

Wide World

A LOVELY THOROUGHFARE IN SANTANDER, ON THE BAY OF BISCAY

notoriously slow, partly because of a failure to introduce modern methods and machinery and partly because of the existence of vast private estates. Much of the land included in these estates is not cultivated at all; the rest is worked by peasants, as in medieval times. The powerful landowners violently opposed Republican attempts to parcel out the land to the peasants. The present government has supported the age-old system, despite the fact that it seriously limits food production for the nation as a whole.

Approximately eighty-seven per cent of all the land in Spain is capable of producing crops or can be irrigated and made productive. The products are varied, ranging from oranges, lemons, grapes, and other fruits raised on the terraced, fertilized, and irrigated land along the southern coast, to the cereal crops of the northwest. In the interior there is much wasteland because of the intense heat and dry climate. Stock raising also is common in the north. Everywhere in Spain, however, the vine and olive tree are cultivated, and there are large exports of grapes, raisins, olives, and wine. The Merino sheep is native to Spain, and large numbers are raised. Silk culture is also carried on in parts of Spain.

Fishing is an important industry, the largest catches being sardines, tuna fish, and cod.

In manufacturing, Spain is far behind other countries. Catalonia, the northeastern part of the country, is the leading industrial section. Barcelona, the chief industrial city, produces textiles, metal products, paper, and leather. Other Spanish manufactures are silk, woolen goods, lace, glass, cork products, and products based on agriculture.

Government. Except for a brief period in 1873-75, when a republic existed, Spain was governed as a monarchy until the fall of Alfonso XIII, in 1931. The Second Spanish Republic was organized under the Constitution of December 9, 1931. This Constitution was a progressive document providing for a President and a one-house legislature, or Cortes. Universal suffrage and freedom of religion were authorized.

Pan American World Airways

THE BULLFIGHT IS SPAIN'S FAVORITE SPECTACLE

Spaniards love the color and excitement of the bull ring and make popular heroes of the leading matadors, who must show artistry as well as courage in their performances.

After the civil war, the Falange Español Tradicionalista became Spain's only legal party and set up a totalitarian government, with Francisco Franco as head of the party, Chief of State, *El Caudillo* (the leader) of the Empire, Prime Minister, and Commander in Chief of the Armed Forces. A Franco-appointed cabinet, the party's national council, and the Cortes (re-established in 1942) assist him. According to law, Spain is a monarchy, with Franco as permanent regent. When he dies or becomes incapacitated, a Regency Council will enthrone a king, named by Franco.

A Turbulent History. The history of Spain dates back to about the eleventh century B. C., when the Phoenicians founded several settlements. The people found there were Celts, Iberians, and Celtiberians. The Greeks colonized the peninsula after the Phoenicians. When Carthage grew to power, a Carthaginian colony was established by the efforts of Hamilcar Barca, Hasdrubal, and Hannibal. When the Romans won Spain, two provinces were formed, which existed until the fifth century A. D., when the Visigoths overran the country and founded a kingdom. In 711 the Arabs brought most of Spain under their rule.

From then on, Spain became greater in power; and the Moors, as the Arabs were called, introduced the learning and art that made Spain the most cultured European country during the Middle Ages. But as the years passed, Christian kingdoms sprang up in Northern Spain; and as they became larger and more powerful, the control of the Moors lessened. Aragon and Castile were the dominant Christian kingdoms in the eleventh century, and they expanded until, in the thirteenth century, only Granada remained in the hands of the Moors.

In 1469 Castile and Aragon were united into one kingdom by the marriage of Isabella of Castile and Ferdinand of Aragon; and in 1492 they drove the Moors from Europe by capturing Granada. In 1512 Navarre fell to them, and Spain finally was united under one Christian kingdom.

The fifteenth and sixteenth centuries

were Spain's greatest. She possessed practically all South America, Central America, a large part of North America, and numerous islands in the Pacific and Atlantic oceans. These colonies brought her enormous wealth, and Spain dominated the affairs of the world. The Netherlands and Milan fell to her, as did parts of Africa. Portugal, Naples, Sicily, Sardinia, and the Canary and Balearic islands all were hers for a time.

But Spain had neither the wisdom nor the understanding to hold these vast lands. She had conquered by the sword and ruled in the same manner. Charles I (Emperor Charles V), Philip II, Philip III, and Philip IV were tyrants and bigots. They persecuted thousands for religious reasons and in general became so despotic that insurrections and rebellions broke out everywhere. Spain was defeated by England on the seas, and she lost the Netherlands.

Throughout the eighteenth century, the empire crumbled despite the reforms of Ferdinand VI and Charles III, of the Bourbon Dynasty; and in 1808 Charles IV was forced to renounce the throne. Napoleon then gave the crown to his brother Joseph; but the Spanish people rebelled and recognized Ferdinand VII, who, in 1814, became king. There was a revolt in 1868, and Isabella II, Spain's queen at that time, was driven from the country. Indirectly, circumstances at this time led to the Franco-German War; and from 1870 to 1873, Amadeo, the son of Victor Emmanuel II of Italy, reigned. He abdicated, but after a republic had failed, the Bourbon Dynasty was restored in 1875, with Alfonso XII as king. The Bourbons remained until 1931. In the meanwhile, Spain, after a war with the United States (in 1898), became a third-rate power.

In 1923 revolt again disturbed Spain, with the result that Primo de Rivera became military dictator. He fell in 1930, and with the growth of republican sentiment, Alfonso XIII was forced to yield in 1931. The result was a republic which had a stormy career. Finally, in 1936, after a decisive victory of the progressive, moderate republican faction at the polls, the disgruntled landowners, clergy, and militarists revolted against the established government. Most of the army joined the rebels, and the bloody civil war ensued.

The Insurgents, aided by Germany and Italy, won final victory in March, 1939. A Fascist dictatorship was established, with Francisco Franco as its head. During World War II Spain gave some support to the Axis but was officially neutral.

For additional information, consult the following articles:

Alfonso XIII
Alhambra
Armada
Barcelona
Canary Islands
Castile
Charles V
Ferdinand V
Franco-German War
Granada
Hamilcar Barca
Hannibal
Iberia
Isabella of Castile
Madrid
Moors
Napoleon I
Navarre
Philip II
Spanish-American War
United States of America

SPANIEL, *span'yel.* A number of dogs of different breeds are called spaniels. The name is a corruption of the old French word *espagnol,* meaning *Spanish.*

Water spaniels have long, curled hair on the top of the head and on the body, but short hair on the face, the front of the hind legs, and most of the tail. They weigh about fifty pounds each, and are of a uniform reddish-brown color. They are affectionate and playful, and good retrievers.

Field spaniels are solidly built dogs, each weighing about forty pounds. Their hair is straight and silky and their color is usually reddish brown, solid black, black and tan, or black and white. They are obedient, good-natured pets and deserve the popularity which they seem to enjoy.

Cocker spaniels are smaller than the field spaniels and are used in hunting birds like the woodcock, from which they get their name. Cocker spaniels weigh about twenty pounds.

Clumbers are like the field spaniels, but are larger, weighing about sixty pounds.

Japanese spaniels and *King Charles* span-

WATER-LOVING CANINE
The spaniels are noted for fine disposition, intelligence, and hunting ability.

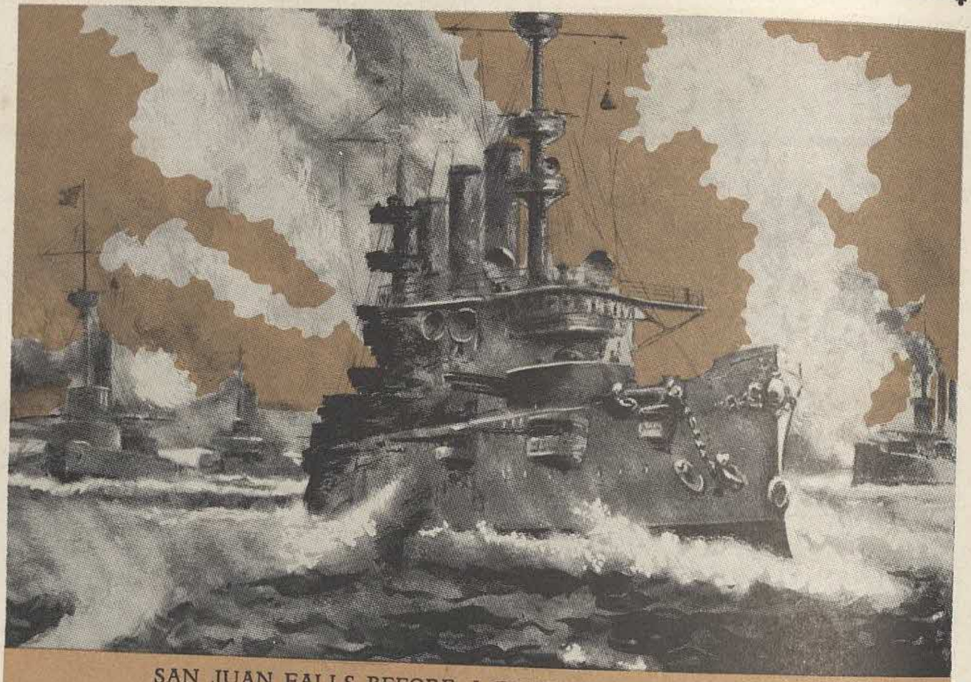
iels are toy dogs. The King Charles is a black and tan English toy spaniel which usually weighs less than twelve pounds. The Maltese and papillon are also toys.

SPAN'ISH-AMER'ICAN WAR. In the Spanish-American War the once mighty empire of Spain, dominant in the New World for over 300 years, received its deathblow, and the United States rose to the rank of a first-rate world power. Fought in 1898, the one-sided war lasted less than four months, the American forces on land and sea being everywhere victorious over the weak and crumbling nation whose proud galleons had formerly commanded the respect and fear of the world.

Causes of the War. Spain had fast been losing her possessions in the Americas. One by one, her lands in Central and South America had revolted; and finally only Cuba, Puerto Rico, and a few other islands in the Western Hemisphere were left. Cuba had been in turmoil for fifty years; and to settle the situation, the United States had offered to purchase the island. Spain had refused, but was unable to cope with the recurring revolutions. In 1895 Cuba again revolted, and Spain over a period of three years proved unable to subdue the island. The sympathies of the people in the United States were with the revolutionists.

On February 15, 1898, the United States battleship *Maine* was blown up in the harbor of Havana. Fanned by the sensa-

THE REGULARS GO OVER THE TOP IN THE BATTLE OF MANILA
Never was victory quicker or more decisive than that at Manila on August 13, 1898.



SAN JUAN FALLS BEFORE A DEADLY RAIN OF STEEL

tionalism of a number of American newspapers, indignation swept the country, although there was no proof that the bombing was the work of the Spanish forces. Congress passed resolutions on April 19, recognizing Cuba's independence, calling on Spain to relinquish her claim to Cuba, and giving President McKinley authority to render aid to the Cubans, if necessary. He approved the action on the 20th and prepared an ultimatum to the Spanish government, requesting a reply by April 23. Spain broke off diplomatic relations, and at the President's request, Congress on April 25 declared that a state of war had existed since April 21.

Military and Naval Events. On April 22 a blockade of Cuba was undertaken. General Shafter was sent to Santiago with about 17,000 men, and advanced steadily, taking the hills of San Juan and El Caney on July 1. In this engagement Theodore Roosevelt and his volunteer Rough Riders won immortal fame. On July 3 a great naval battle was fought, and on July 4 Admiral Cervera, in command of the Spanish squadron, was captured as he tried to break through the blockade with his one remaining ship. The whole district of Santiago was surrendered by General Toraly Velasquez on July 14.

In the meantime, Admiral Dewey on May 1 had crushed the impotent Spanish fleet in the harbor of Manila; and on August 13, after a hard-fought land and naval engagement, Manila was surrendered by Governor General Augustini. The Philippine Islands were under the control of the United States.

Terms of Peace. In the meantime Spain had already made overtures for peace, and on July 30 was advised of the terms of peace upon which the United States would insist. A preliminary protocol of peace was signed on August 12, the day before Manila was taken; and the final treaty was signed in Paris on December 10, 1898. After the required ratification, it was proclaimed on April 11, 1899.

Under the treaty Cuba's independence

PRIMA DONNA OF THE SPARROW FAMILY
Above, the song sparrow, lovely feathered vocalist of Eastern United States. Right, the sparrow hawk, mortal enemy of field mice and destructive insects.

was acknowledged, Puerto Rico and Guam were given to the United States as an indemnity, and the Philippines were ceded, the United States paying $20,000,000.

Only a few hundred Americans were killed in battle. Far more died of disease.

For additional information, consult the following articles:

Cuba
Dewey, George
McKinley, William
Philippine Islands
Puerto Rico
Roosevelt, Theodore
Rough Riders
United States of America

SPANISH SUCCESSION, War of the. See Succession Wars.

SPAR'ROW. In all North America, there is no better known bird than the sparrow. From the densest sections of the most crowded cities to the wildest forest areas, these cheerful little members of the finch family make their homes; for if sparrows have an outstanding trait, it is their remarkable adaptability to their surroundings. No birds are more prolific, largely because of their protective coats of dull brown or gray. They vary from five to seven inches in length. Most sparrows feed and nest on or near the ground. Their bills are blunt and cone-shaped, perfectly suited to their diet of seeds.

By far the most common species is the *English,* or *house,* sparrow, introduced into America about 1850. Welcome at first, these birds have now become so numerous that they are real pests, driving out such charming songsters as the wrens, bluebirds, and martins and filling the air with an incessant and unpleasant din of chirping. The best-known domestic sparrows include the *chipping* sparrow, a delightful little chestnut-crowned creature with grayish under parts, and the *field* sparrow, which avoids society and lives in the dry, bushy uplands.

The *tree* sparrow is one of the few species that winters in Northern United States, while the *swamp* sparrow is a resident of the low, coastal marshes. The musical members of the family are: the happy *song* sparrow, which summers from the Gulf to Canada; the *vesper* sparrow, a twilight singer; and the *white-throated* sparrow, a pert whistler of the Canadian border. The best-known western species include the *white-crowned* sparrow of the Rockies and Sierra Nevadas, and the *fox* and *Harris* sparrows of the prairies.

SPARROW HAWK. Smallest of the North American falcons, the sparrow hawk is found commonly during the breeding season in most sections of the United States,

THE HEROIC STAND OF THE SPARTANS AT THERMOPYLAE

Vainly attempting to stem the Persian horde in a narrow mountain pass at Thermopylae, Leonidas and 300 courageous Spartans bravely perished. As a tribute to their bravery, the spot was later marked with a stone lion. In land fights, the Spartans had no equal.

Canada, and Northern Mexico. It winters throughout most of the United States, and in Mexico and Central America. It is somewhat larger than a robin, with a reddish back barred with black, reddish tail with a black band and white tip, and bluish head with a reddish crown patch. The male has bluish wings and spotted under parts, while the female has reddish wings and streaked under parts.

The sparrow hawk is often seen perched on a telephone pole or dead limb watching for its prey of insects and small rodents. On spying a grasshopper or mouse it flies down and often hovers in the air an instant before striking its victim. Occasionally, small birds are captured, but on the whole the sparrow hawk is not an especially injurious bird.

SPAR'TA, or LACEDAEMON, *las e de' mon.* As different as day is from night were the ancient Grecian cities, Sparta and Athens. Rivals in the struggle for dominance, one lived by the sword, the other cultivated art and learning. Athens contributed more to civilization's progress than any other city of antiquity; Sparta has only a record of militarism and bravery.

The Spartan Character. Sparta, located on the Eurotas River, was the chief city of the Peloponnesus. Yet, despite her prominence, she built no imposing temples or statues, wrote no histories, had no great philosophers and dramatists. Her people were rugged and stern, disdaining cultural accomplishments for brave and glorious deeds of war. They lived austerely, ate plain and meager food, and drank only a little wine. No free Spartan was allowed to engage in business or farming, these duties being taken care of by the Helots and the Perioeci, who had no voice in the government.

Every male Spartan up to the age of sixty had to take part in military drill and athletics. From infancy, Spartan boys were taught discipline and were conditioned against hardship. If a baby was not judged perfect, he was taken to the mountains and abandoned to die. A child considered suitable for military purposes was taken from his family at the age of seven and placed in a public institution, where he learned the principles of physical training and war, and where he ate with the other children of the city. When he was twenty years old, he went to live in the public barracks where the army was quartered, and there he continued his training under arms. At thirty he became a citizen and was required to marry, but he still ate at the public board.

Despite the fact that the Helots and the Perioeci were more numerous than the Spartiates, the city was run entirely for and by the citizens. The government was an oligarchy, ruled by two hereditary kings and five ephors, who were Spartiates chosen annually, probably by lot, to serve on this administrative council. Secret police disposed of any dissenters against the government.

History. Legend says that Sparta was founded by Lacedaemon, the son of Zeus, and that Menelaus was her greatest king. Actually, it is believed that Sparta was founded by Dorians who invaded the peninsula about 1000 B. C. Lycurgus, said to have lived in the seventh century, B. C., was responsible for the system of rigid laws governing the city.

The Spartans carried on a series of wars that raised them to supremacy in Greece. They conquered Laconia and took the inhabitants as slaves. They also subdued the Messenians, the Arcadians, and the Argives. In the fifth century they took part in the Persian wars, but arrived too late at Marathon to share in the glorious victory of the Athenians, and basked only in the reflected glory of Athenian strategy in the naval victory of Salamis. The most notable instance of the heroism of Spartan warriors was the brave sacrifice of Leonidas and his band of 300 at Thermopylae, in futile defense of the pass through the mountains.

Sparta's challenge of the supremacy of Athens after the Persian wars resulted in the Peloponnesian War, which Sparta won. In 371 B. C., however, she was defeated at Leuctra by Thebes, and quickly declined as a great power. In 146 B. C., with the rest of Greece, Sparta became a part of Rome. The city was destroyed by the Goths in the fifth century. A village called Sparta was built in 1834 on the site of the ancient city.

For additional information, consult the following articles:

Athens
Dorians
Greece
Helots
Lycurgus
Menelaus
Peloponnesus
Philip II (Macedon)
Thermopylae

SPAR'TACUS. In the year 71 B. C., mighty Rome trembled before the advance of 90,000 oppressed and maddened slaves determined to gain liberty or die in the attempt. They were led by Spartacus, a Thracian who had been captured by the Romans and sold to a gladiatorial school at Capua. In 73 B. C. he escaped with seventy other slaves. The little band fled to Mount Vesuvius and were joined by thousands of other rebellious slaves. Ere long, the army overran all Southern Italy, sacking many cities. Two Roman armies sent against the slaves were defeated in 72 B. C., but the following year the forces of Spartacus were trapped by Crassus. After breaking through the enemy lines, Spartacus reassembled his forces at Calabria, where his army was defeated, ending the uprising. Spartacus was killed, and more than 6,000 captive slaves were heartlessly slaughtered along the Capua-Rome highway.

SPEARMINT, *speer'mint.* Native to Europe and Asia, spearmint has become a familiar plant in America. This popular perennial grows to a height of about two feet and is easily identified by its purplish flowers, sharp-ended leaves, and pleasant aroma. Most of the spearmint in the United States is grown in Michigan. The chief product of the plant is spearmint oil, used in the manufacture of chewing gum, in juleps, and as a popular kitchen flavoring for soups and sauces.

SPECIE, *spe'she,* **PAYMENTS,** RESUMPTION OF. No greater financial crisis ever harassed the United States Treasury than that which came at the close of the Civil War, when it was faced with the redemption in specie, or gold, of more than $400,000,000 worth of Federal greenbacks (paper money printed in green ink). Early in the war the government had been forced to suspend specie payment. It issued, instead, an ever-increasing volume of United States notes, backed only by the integrity of the government. As a consequence, prices rose sharply and the nation faced a monetary panic. In order to improve the country's credit, Congress passed the Funding Act of 1866, which provided that the greenbacks should be retired at the rate of $4,000,000 monthly.

This method proved unsatisfactory, and in 1875 Congress passed the Resumption Act, which provided for the complete redemption in specie of all notes on January 1, 1879. By selling bonds, the Treasury accumulated about $140,000,000 in gold for this purpose. But since the notes were then "as good as gold," few were presented for payment on the appointed day. See GREENBACKS.

SPECIES, *spe'sheez.* There are so many thousands of kinds of plants and animals in the world that it took scientists a number of centuries to find a satisfactory method of listing them methodically, so that their similarities and differences could be studied. Now, however, every known plant and animal has its regular place in the great list, which is divided into kingdoms, subkingdoms, or phyla, groups, classes, orders, families, genera, and species. The resemblance between the words *special* and *species* is worth noting. The one is derived from the other, and a species may be thought of as a special kind. Note also that the singular and the plural of *species* are the same. *Yellow* pine and *sugar* pine are species of the genus *Pinus.* See BOTANY; ZOÖLOGY.

SPECIFIC, *spe sif'ik,* **GRAV'ITY.** See GRAVITY, SPECIFIC.

SPEC'TACLES. Millions of people whose eyes are defective are able to see normally only because they wear spectacles. These remarkable devices permit reading and study by persons who might otherwise be victims of severe headaches and progressive degeneration of the eyes.

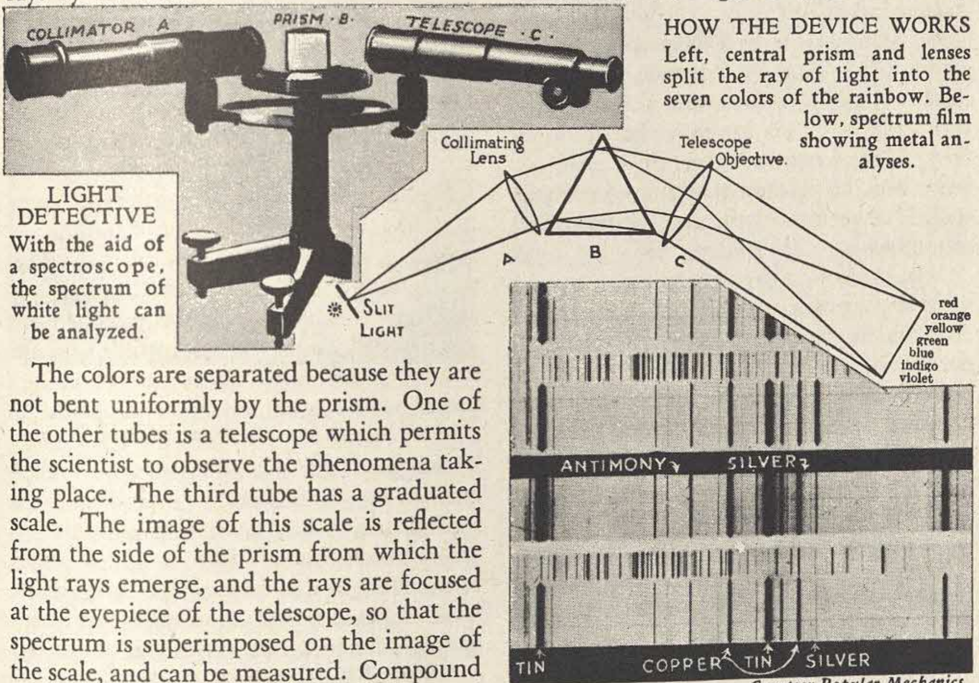
According to some, the Chinese wore spectacles centuries before the Christian Era. Others say that they were invented by Englishman Roger Bacon in the 1200's A.D.; still others that a Florentine monk was the inventor. In any case, it was not until the 1700's that enough was known of light refraction to permit the grinding of effective lenses. *Bifocals,* each lens of which is made up of two different lenses, were invented by Benjamin Franklin.

Today lenses are ground from fine optical glass to suit the defect of each eye, and most visual defects can be corrected by properly fitted glasses. One should, however, buy only glasses that have been prescribed by a skilled eye specialist. Farsighted persons require convex lenses; nearsighted ones, concave lenses. Astigmatism requires lenses that bring the light rays to focus on the retina.

Sunglasses, which have colored lenses, some of them made of polarized glass, are used to protect eyes from the sun's glare. Special *safety glasses* also are widely used, to protect the eyes of many industrial workers, such as arc welders.

Lenses are often mounted in a metal, tortoise-shell, or plastic frame. Some, however, have no frames and are held together by a nosepiece. Still others, called *contact lenses,* fit directly over the eyeball, under the eyelid. The *monocle* is a single lens, held in place by the outer eye muscles. See EYE; LENS.

SPECTROSCOPE, *spek' tro skope.* An instrument of immeasurable value to scientists, the spectroscope is used to study the spectrum of a luminous body. Spectra are the bands of color produced when a prism breaks up the light rays from luminous objects. The spectroscope consists of a triangular prism enclosed in a case which is fastened to an upright shaft. From the sides of the case three tubes extend, each of which is approximately equidistant from the others. One of these tubes, called the *collimator,* has at the end nearest the prism a double-convex lens, and at the other end two adjustable pieces of metal which form a slit-shaped opening. Light coming through the slit is bent into parallel rays by the lens.



LIGHT DETECTIVE
With the aid of a spectroscope, the spectrum of white light can be analyzed.

HOW THE DEVICE WORKS
Left, central prism and lenses split the ray of light into the seven colors of the rainbow. Below, spectrum film showing metal analyses.

Courtesy Popular Mechanics

The colors are separated because they are not bent uniformly by the prism. One of the other tubes is a telescope which permits the scientist to observe the phenomena taking place. The third tube has a graduated scale. The image of this scale is reflected from the side of the prism from which the light rays emerge, and the rays are focused at the eyepiece of the telescope, so that the spectrum is superimposed on the image of the scale, and can be measured. Compound spectroscopes have several prisms arranged in an arc to magnify the degree of color separation.

The spectroscope has not only made the determination of the composition of luminous bodies possible, but also has been of particular value in the study of the velocity, temperature, age, composition, and distance from the earth of heavenly bodies. See Spectrum Analysis.

SPECTRUM, *spek'trum,* **ANALYSIS.** When rays of light from a luminous substance are passed through a prism, the rays are broken up into a band of colors (see Light). This band of colors is the spectrum of the luminous body. All luminous substances emit light through incandescence, and the spectrum of each substance differs from all others. Through the study of spectra, astronomers have been able to determine the nature, composition, temperature, and age of heavenly bodies. Spectrum analysis is also of immense value in the study of metals. The instrument used in analyzing spectra is the spectroscope.

There are three types of spectra—the *continuous,* the *bright-line,* and the *dark-line,* or *absorption,* spectra. A complete, continuous spectrum is possible when a substance, such as metal, is heated to a white heat. An incomplete continuous spectrum may be had when the metal is raised only to a red heat. The spectrum of the sun, called the *solar* spectrum, is a continuous spectrum, showing seven colors on the spectroscope screen, each color blending into the one adjacent, with no sharp line of demarcation.

A bright-line spectrum results from gases and vapors which are heated to incandescence under ordinary pressures. It is through bright-line spectra that substances may be identified. For example, strontium may be identified by a narrow blue line in addition to a wide band of red and orange in its spectrum. Sodium has a single bright-yellow-line spectrum, while barium has a wide spectrum with lines in all colors. Bright-line spectra of compounds and mixtures show all the lines of all the component elements. Minute quantities of elements can be detected by spectrum analysis. Several elements, notably helium, have been discovered in this way.

In continuous spectra there are no bright lines. There may be, however, fine, dark lines. These dark lines are identical with the bright lines of a luminous gas or vapor. The bright lines, however, have been absorbed by the placement of a non-luminous vapor between the luminous substance and the observer. These dark lines are commonly known as *Fraunhofer* lines, named after the scientist who charted some 600 of them in the solar spectrum. See SPECTROSCOPE.

SPELLING. It is important in either business or social life to be able to spell correctly; without this ability, no one can hope to write acceptably. Businessmen often complain about the poor spelling ability of their employes, a shortcoming caused, no doubt, by the fact that spelling is often a much-neglected subject in the common schools of today. To impress upon school children the importance of spelling, regular spelling matches are held, prizes are given, and state and national championships are awarded annually.

The Difficulties of Spelling. The correct placing of letters in forming words would seem, at first glance, a simple matter. The greatest difficulty lies in the English language, in which more than one combination of letters may represent the same sound, as *ow* and *ough*. In other cases, the same combination may represent different pronunciations in different words, as *ough* in *rough, cough,* and *through*. In other languages, such as Spanish, spelling is facilitated by the fact that each letter has its own sound; that is, it is phonetic. In spite of the fact that Americans use the English language, there is a considerable difference in the spelling of some words. In England, for example, *valor* is spelled *valour, tire* is spelled *tyre,* and *color* is spelled *colour*. Another common stumbling block is the constant addition of new words to the language, as *camouflage* and *putsch,* which have come into the English language through common usage. See ORTHOGRAPHY.

SPENSER, THE "POET'S POET"
Famed for the exotic melody of his poetry, he is best known for his archaic *Faerie Queene.*

SPEN'SER, EDMUND (1552?-1599). A poet whose work had a marked influence on succeeding writers and who was considered the leading non-dramatic poet of the age, Edmund Spenser is known today largely for his famous allegory, *The Faerie Queene.* This great poem consists of six books, each portraying a cardinal virtue as embodied in a knight. The language of the poem is old, and the meaning is often obscure; but through it shines the serene beauty of Spenser's melodic poetry.

Spenser was born at East Smithfield, London, and in 1576 received his master's degree from Cambridge. He later became a member of the household of the Earl of Leicester and was introduced at court by Sir Philip Sidney. In 1579 he published a series of pastoral poems *The Shepheardes Calendar*. In 1580 Spenser went to Ireland as Lord Grey's secretary; and for his part in quelling Desmond's rebellion, he was given much of Desmond's estate, where he lived after 1586. Here Spenser worked on *The Faerie Queene* and published the first three books in 1590, dedicating them to Queen Elizabeth.

Spenser's courtship and marriage (1594) are celebrated in a series of sonnets (the *Amoretti*) and the remarkable *Epithalamion.* A visit to London soon afterward saw the publication of three more books of his great allegory and also his *Foure Hymnes.* Upon his return to Ireland, about 1598, he was made sheriff of county Cork; but in a rebellion his home was burned and he was forced to flee to England, where he died the following January. Spenser is buried in Westminster Abbey.

SPERMACETI, *spur ma se′ te.* A waxy substance found in the head cavities and the blubber of the sperm whale, spermaceti is used principally in making candles, ointments, and face creams. In the living whale it is mixed with a heavy oil; but when exposed to air, spermaceti separates in heavy, white flakes. After purification, this substance is yellow and semi-transparent, somewhat resembling tallow. The whales usually yield about twelve barrels of spermaceti. See SPERM WHALE.

SPERM OIL. Separated from the blubber and spermaceti of the sperm whale, sperm oil is a very pure oil. It is used as a lubricant, in soapmaking, in dressing leather, and in the manufacture of printing inks. Its composition differs little from that of ordinary whale oil.

SPERM WHALE, or CACHALOT, *kash′ a lot.* Numerous substitutes for its products have considerably lessened the importance of the sperm whale in industry, but it is still prized for its oil, spermaceti, ambergris, and its ivory-like teeth. Sperm whales belong to the suborder of toothed whales; the adults often reach a length of from fifty-five to sixty feet or more. They are found in sea waters from the North Atlantic around Cape Horn to the North Pacific. The range of the male is especially great, including the frigid waters of the Arctic and the Antarctic oceans. These whales are found in schools, being gregarious.

EGYPT'S GREAT SPHINX AT GIZEH

Though marred by the ravages of time and sandstorms, it still guards the Nile Valley. Others, resembling Egyptian kings, also exist.

Their heads are enormously large, often comprising fully a third of the body. Near the forepart of the head is located an S-shaped blowhole. The lower jaw contains from forty to fifty teeth, but the upper is toothless. The whales feed principally on shrimps, squid, and cuttlefish.

For additional information, consult the following articles:

Ambergris
Spermaceti
Sperm Oil
Whale

SPHINX, *sfingks.* Living near Thebes, according to ancient Greek myths, was a fabulous monster called the Sphinx. This creature had the head of a woman, the body and claws of a lion, the wings of a bird, and the tail of a serpent.

It was said of the Sphinx that she stopped all travelers passing by and asked them this question: "What walks on four feet in the morning, on two at noon, and on three in the evening?" When the travelers failed to answer, she killed them. One day, however, Oedipus passed by and was asked the same question by the Sphinx.

He answered, "Man crawls on four feet as a baby, walks upright on two feet in the prime of life, and uses a staff in old age." The riddle being solved, the Sphinx threw herself over a cliff, and Oedipus became the ruler of Thebes.

The Sphinx of Egypt, where the idea of the fabulous monster probably originated, was always represented lying down. It differed from the Greek images in having the head of a man and no wings. Sphinxes were often placed in pairs at the opposite sides of temple doors and tombs to protect the dead from evil spirits.

Near Gizeh, close to the famed pyramids, is a huge statue of the Sphinx, carved out of solid rock. It was designed according to orders of Chephren, son of Cheops, the creator of the Great Pyramid. Originally, the body of the Sphinx was painted red, the headdress white, and the eyes were of a natural color. The figure is 189 feet long, and the front paws, built of masonry, are fifty-six feet long. The height is sixty-six feet. The Sphinx has been covered by the desert sands many times, and the original coloring has disappeared.

SPICE, *spise.* It is said that in the East Indies, especially near the Moluccas, or Spice Islands, sailors can often tell when they are nearing land long before they can see it, for the fragrance of innumerable sweet-smelling flowers and trees floats many miles out over the seas. Many of these trees bear flowers or nuts or berries, or even bark, which are not only pleasing in smell, but if properly prepared may add zest to our food.

Some of these spices from this part of the world have been known to the European world for more than 2,000 years, and for many centuries their source was a fascinating mystery. Huge fortunes have been made in the spice trade, explorers have dared bold adventures for its sake, and nations have fought wars over it. Today many of the spices native to the East are grown in other parts of the world, and some spices have been discovered elsewhere, but the region around Singapore still remains the greatest spice country.

Consult the following articles for descriptions of the different spices:

Allspice
Caper
Capsicum
Caraway
Cinnamon
Cloves
Ginger
Mustard
Nutmeg
Paprika
Pepper
Saffron

SPICE ISLANDS. See Moluccas.

SPI'DERS. Best known of the small animals about us which look like insects, spiders belong to the class *Arachnida.* They differ from insects in having eight legs instead of six, and in lacking antennae, or feelers. Also, the heads of spiders are not separated from the thorax, or part of the body where the legs are attached, as are those of insects.

The old nursery rhyme—

"Will you walk into my parlor?"
Said the spider to the fly—

and our familiarity with spider webs leads most of us to believe that all spiders live by trapping their victims. On the contrary, half of the ten principal families of American spiders are hunters, running or jumping to catch their prey. Some live among flowers, waiting to grasp any insect attracted by the blossoms; others make tube-shaped nests among dead leaves or stones or in short grass; still others spin webs only as homes for their young, usually running about the ground with no effort at concealment. So in classifying spiders it is convenient to divide them into two types: the *hunting* and the *cobweb* spiders.

Spiders usually construct silken cocoons in which to lay their eggs. Some kinds carry these cocoons with them for weeks at the time the eggs are developing. These cocoons are carried partly back of and partly beneath the abdomen, and are often mistaken for a part of the spider. Other kinds of spiders attach their cocoons to webs and leave them. Sometimes, too, young spiders hatch in the fall, but remain in the cocoons all winter.

All spiders are eaters of other insects and are more or less beneficial. So far as is known, only one form found in the North is poisonous. This is called the *black widow.* It is from one-fourth to one-half inch in length, is shining black in color, and has an irregular, red patch on the underside of the abdomen. See TARANTULA; TRAPDOOR SPIDER.

SPIDER WEB. All of us are familiar with the beautiful big orb webs found in our gardens in late summer. We are no less familiar with the cobwebs in houses (see COBWEBS). Several other types of webs, no less ingenious and beautiful, escape our notice because they are not so easily seen. Among these are the funnel webs and tubelike webs which are generally found near the ground in woods and meadows.

The webs are made of silk produced within the body and spun out through very complicated little organs. The organs are located on the underside of the tip of the abdomen, and are called *spinnerets.* Most spiders have several kinds of spinnerets and may spin silk in different forms, ranging from fine threads to rather broad ribbons. The threads spun from some spiders are so fine and so uniform in texture that they were once the only material that could be used to make the cross lines in surveying instruments. The threads are so strong that a rope made of them would be three times as strong as an iron rope the same size.

SPIKENARD, *spike'nurd,* **or NARD.** For centuries the spikenard has been a highly prized perfume. It was valued by Greeks, Romans, and Eastern peoples as an ointment and bath perfume, and in the Orient today is used for the same purposes to some extent. Spikenard is mentioned in the Bible as an ointment poured over Jesus' head by an admirer. Even in that early day, it was worth a great deal of money.

The spikenard plant is a member of the valerian family and is a native of India and the East Indies. It has a fleshy, bitter, but aromatic, root from which the oil for perfume and ointments is obtained.

American spikenard, or *Indian root,* which belongs to the aralia family, is found in Northern United States and Southern Canada. Its large, fragrant roots, which resemble those of sarsaparilla plants, are used in the preparation of medicines.

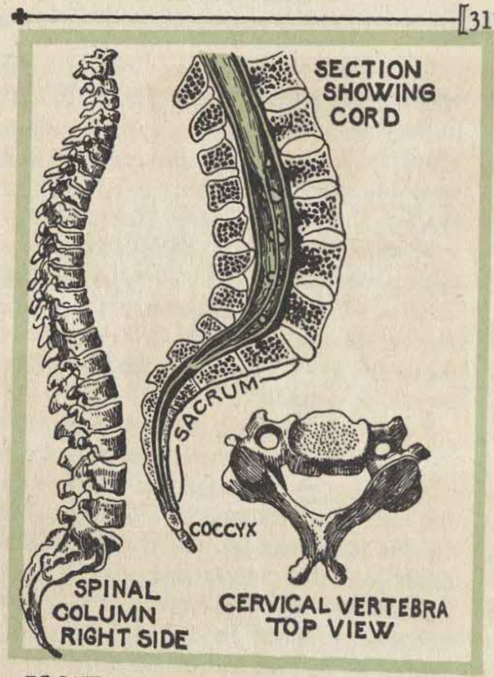
SPINACH, *spin'ich.* Rich in iron, phosphorus, and calcium, as well as in vitamins A, B, and C, spinach is a valuable vegetable in the diet of man. Its leaves may be prepared as a cooked vegetable, or as greens in soup.

Spinach, an annual, probably originated in Asia. There are two varieties of the common, or garden, spinach: *prickly* spinach and *smooth* spinach. The latter is by far the most popular and is identified by blunt, roundish leaves and smooth fruit. In regions where the climate will permit, spinach is sown in the fall, growing quickly to market size in the early spring. It is essential that the seed bed be fertile, and that spinach grow luxuriantly, for if it grows slowly it is tough and bitter.

SPI'NAL COLUMN, *kol'um.* Extending down the middle of the back is the bony structure that forms the main axis of the body. This spinal column, or backbone, supports the head and provides a place of attachment for the ribs and hip bones, which in turn are connected with the arms and legs.

The spinal column consists of twenty-six individual bones, twenty-four of which, called *vertebrae* (singular, *vertebra*), are similar in structure. Man and all animals possessing a backbone are known as *vertebrates,* from this term. In the vertebral column there are seven neck bones, the *cervical* vertebrae; twelve chest bones, the *dorsal* vertebrae, to which the ribs are attached; and five in the region of the loins, the *lumbar* vertebrae. The last lumbar vertebra rests on a strong, three-sided bone known as the *sacrum,* or "sacred bone," so-called because it was once used in animal sacrifice. The end bone is called the *coccyx* (Latin for *cuckoo*), from its resemblance to a cuckoo's bill.

At birth the sacrum consists of five sep-



PROTECTOR OF THE SPINAL CORD
The spinal column also supports the torso and serves as an anchor for muscles and ligaments.

arate small bones and the coccyx of four. These bones later become firmly united. Together with the hip bones, the sacrum and coccyx form the bones of the pelvic cavity.

The successive openings of the series of bones form a long tube which holds and protects the spinal cord, the body's main nerve trunk (see NERVES; NERVOUS SYSTEM). The vertebrae themselves are separated from one another by pads of cartilage, which serve as shock absorbers and lessen jarring. A study of the contour of the spinal column will show another reason why a good deal of jarring is prevented. There are four distinct curves down the column, and these give the backbone the elasticity of a spring. In fact, the spine is considered one of the most wonderful pieces of mechanism in the body. It is constructed to give support, to distribute weight, and to insure ease and freedom of movement. See SKELETON.

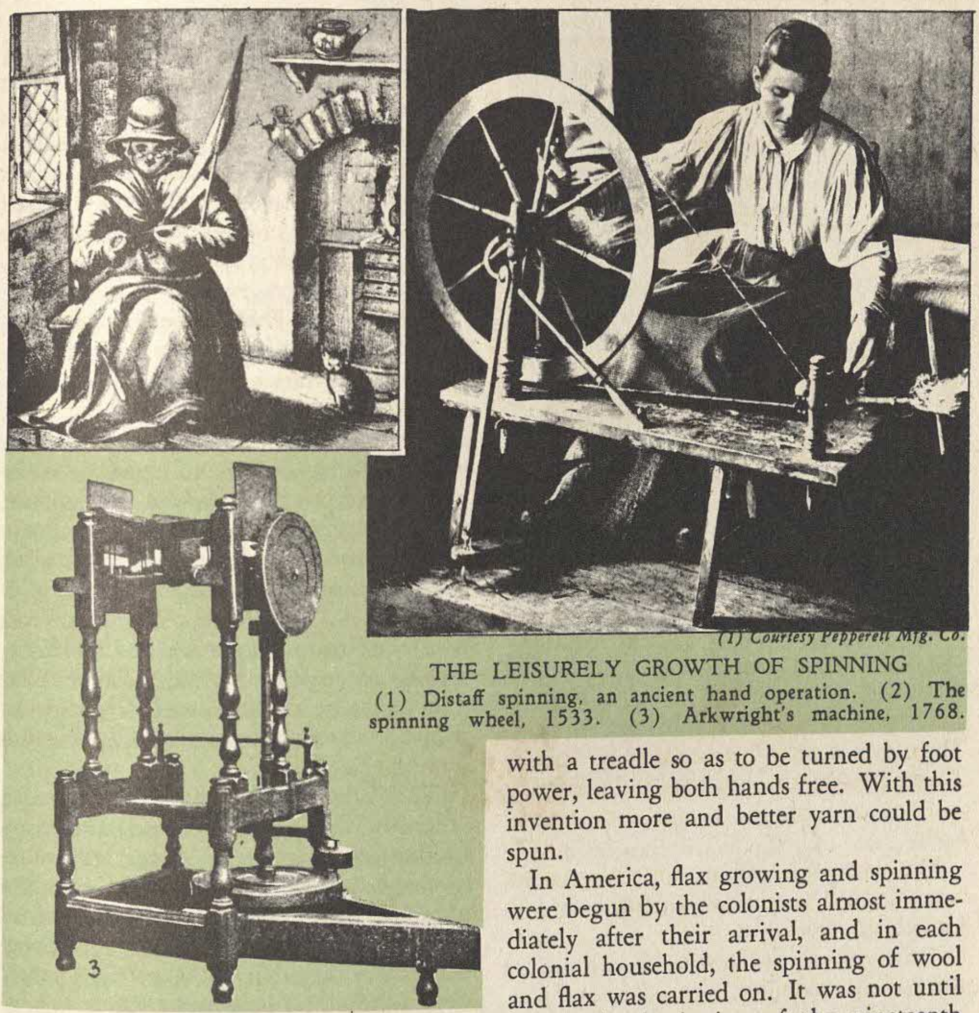
SPINAL CORD. The central communicating nerve line between various parts of the body and the brain is the spinal cord, which runs through the bony spinal column. It is composed of nervous tissue, which, in turn, consists of a central canal surrounded by the gray matter, and then the white matter. The cord is suspended by ligaments and membranes which nourish it and furnish protection. Thirty-one pairs of nerves are attached to the spinal cord. See BRAIN; NERVOUS SYSTEM.

SPIN'NING. Even before the spinning of yarn was done to provide for the making of cloth, strands of twisted fibers were used by primitive peoples for tying, for trapping wild animals, and for making nets for fishing. Strips of bark and leaves, tough, wiry stems of trailing or climbing vines, and skins and tendons of animals killed for food were all doubtless used for twisting into cords and string in those early days. Among the relics of earliest man, thousands of years old, beside the remains of animals extinct before history began, bone needles, awls, and implements bearing the marks of cords have been found.

The purpose of spinning is to combine a number of more or less weak and short separate fibers into a yarn or thread having increased strength and greater length. To bring this about, the material to be spun must be spread out and the fibers arranged lengthwise. Then it must be twisted to press and hold the fibers close together, and the yarn must be wound as fast as it is spun, to prevent it from getting tangled or knotted.

Gradual Development as a Home Industry. When yarn began to be made for weaving into cloth, it was found that it had to be free from knots and weak places and evenly twisted. Methods and appliances were gradually developed through a period of many thousands of years to make better and more yarn and, later, yarn at less expense. After improved handspinning methods came the hand spindle, spinning wheel, spinning jenny, spinning frame, and power machine.

The use of the spindle was the first step



(1) Courtesy Pepperell Mfg. Co.

THE LEISURELY GROWTH OF SPINNING
(1) Distaff spinning, an ancient hand operation. (2) The spinning wheel, 1533. (3) Arkwright's machine, 1768.

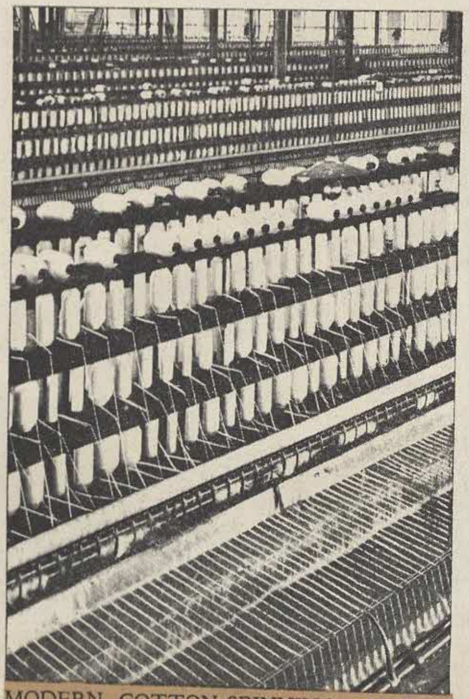
in the invention of textile machinery, and it began so long ago that we cannot fix a date. The spindle was first spun with the fingers and later rolled with the right hand against the thigh. Then a method of supporting the spindle, by thongs of rawhide or leather or loops of twisted fiber, was invented, and the spindle was made to turn by means of a cord and a revolving wheel.

A simple spinning wheel of this type has been used in the Orient since prehistoric times, but it was not introduced into Europe until about the fourteenth century. During the next three centuries, improvements in the spinning wheel took place and a wheel was invented that was fitted with a treadle so as to be turned by foot power, leaving both hands free. With this invention more and better yarn could be spun.

In America, flax growing and spinning were begun by the colonists almost immediately after their arrival, and in each colonial household, the spinning of wool and flax was carried on. It was not until almost the beginning of the nineteenth century that small factories run by water power were started.

Modern Factory Spinning. Spinning in the United States and other industrialized countries has disappeared as a home industry, and is carried on in factories with the aid of wonderfully complicated machinery. Machines have been developed not only to spin threads with far greater speed and uniformity than is possible by hand, but to turn out kinds of yarn and threads that it would be impossible to make with the old hand implements used when spinning was done in the home.

The first American cotton-spinning ma-



MODERN COTTON-SPINNING "MULES"
Here the rovings are drawn out and twisted into finished yarns ready for weaving.

chine to be operated by other than hand power was built by Samuel Slater in 1790, and was so efficient that it soon spun cotton yarn so fast that it taxed the looms then in operation.

There also has been developed elaborate machinery for processes preparatory to spinning: machines for loosening straightening, cleaning, combing, and arranging the raw fibers properly for the spinning machines themselves.

The modern spinning frame is like several hundred spinning wheels fastened together and running at one time, with the spindles turning around at the almost unbelievable speed of from 6,000 to 10,000 times per minute. A large spinning mill will have anywhere from 10,000 to 20,000 of these spindles turning at one time and tended by an army of workers who have to start the threads on each spindle, tie together the broken ends of any strands that break, and take off the bobbins or cops of yarn when the spindles have spun and wound up on themselves all the yarn they should hold.

Other machines rewind the spun yarns into skeins or other kinds of packages according to the special purpose for which each kind is intended. The yarn is then ready for dyeing, or for the loom or knitting machine that is to manufacture it into a fabric. See WEAVING.

SPIN'NING WHEEL. See SPINNING.

SPIRAEA, *spi re' ah.* In the large rose family, the genus known as *Spiraea* comprises a number of attractive and ornamental shrubs and herbs. Their flowers grow in dense clusters and may be either white, pink, or purple. A well-known species is *Van Houtt's* spiraea, a large, bushy shrub which bears clusters of white flowers on long, arching branches. Another popular kind for decorative purposes is the *bridal wreath,* which has heavy masses of feathery white flowers. The *meadowsweet* is a handsome native species that has become a troublesome weed in New England.

SPITSBERGEN, *spits' bûr gen.* An archipelago, or group of islands, belonging to Norway, Spitsbergen is about 360 miles north of Norway in the Arctic Ocean east of Greenland. Its Norwegian name is Svalbard. The principal islands are West Spitsbergen (or Mainland), North East Land, Prince Charles Foreland, Edge Island, Barents Land, King Karl's Land, Hope Island, and Bear Island. The total area of the islands is 24,294 square miles, and the population is about 2,200.

A rugged land of rocky fjords, mountain peaks, and glaciers, Spitsbergen nevertheless has some fertile valleys. Whales, seals, walruses, and various kinds of fish abound in its Arctic waters; and at one time hares, polar bears, foxes, and reindeer were plentiful in the land. Eider ducks thrive along the coast.

Coal is extensively mined and exported. Other minerals found in lesser quantities are copper, iron, mica, phosphate, asbestos, gypsum, marble, and zinc.

Despite the generally Arctic climate, the harbors of the west coast are open six or seven months out of the year, owing to the North Atlantic drift.

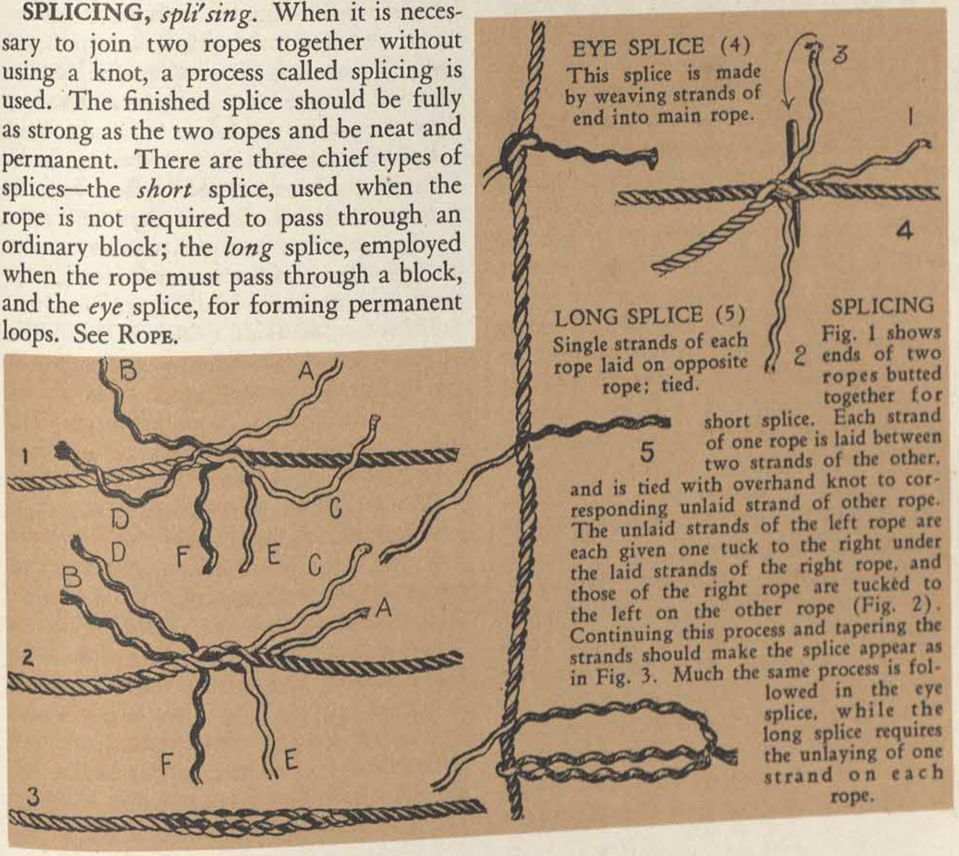
Discovered by Norwegians in 1194, Spitsbergen was recognized as Norwegian territory in 1920 by a treaty signed at Paris to settle the question of ownership. It was formally annexed to Norway in 1925. Spitsbergen has been a point of departure for a number of Arctic explorers.

SPITZ, *spits,* **or POMERA'NIAN, DOG.** The spitz is a medium-sized or small dog with a sharp, pointed nose, pointed ears, long hair, and tail curved over the back. The coat is usually of one color and may be black, white, brown, red-brown, or creamy. In America spitz dogs are regarded as pets. In its native home in Pomerania, Germany, the spitz is trained to tend sheep.

SPLICING, *spli'sing.* When it is necessary to join two ropes together without using a knot, a process called splicing is used. The finished splice should be fully as strong as the two ropes and be neat and permanent. There are three chief types of splices—the *short* splice, used when the rope is not required to pass through an ordinary block; the *long* splice, employed when the rope must pass through a block, and the *eye* splice, for forming permanent loops. See ROPE.

THE ARISTOCRAT OF DOGDOM

Noted for his "one-man" characteristics is the spitz, a native sheep herder of Germany.



EYE SPLICE (4)

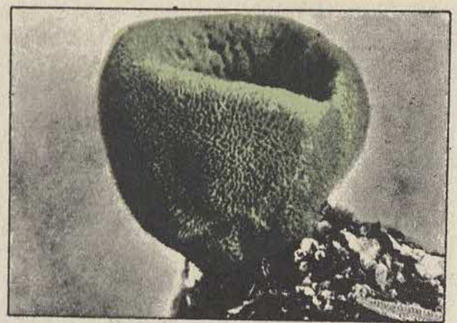
This splice is made by weaving strands of end into main rope.

LONG SPLICE (5)

Single strands of each rope laid on opposite rope; tied.

SPLICING

Fig. 1 shows ends of two ropes butted together for short splice. Each strand of one rope is laid between two strands of the other, and is tied with overhand knot to corresponding unlaid strand of other rope. The unlaid strands of the left rope are each given one tuck to the right under the laid strands of the right rope, and those of the right rope are tucked to the left on the other rope (Fig. 2). Continuing this process and tapering the strands should make the splice appear as in Fig. 3. Much the same process is followed in the eye splice, while the long splice requires the unlaying of one strand on each rope.



HOW THE THIRSTY SPONGE GROWS

Pictured is the Venus' flower basket. Sponges fasten themselves to the sea bottom and gather food from the circulating ocean currents.

SPONGE, *spunj.* The sponges that most of us know are the internal skeletons of animals that live on the bottom of the sea and are permanently fixed to it. They form a separate branch, or phylum, and are the lowest branch of the many-celled animals. Zoölogists call this branch *Porifera,* meaning *pore bearers.* Living sponges are much like clumsy masses of jelly. The living animals are of different colors—gray, purple, red, and so on. They may be round, cup-shaped, vase-shaped, or irregularly branched. One of the most interesting species is Venus' flower basket; the skeleton of this sponge bears a striking resemblance to a very deep flower basket.

The walls of a living sponge are penetrated by many canals. Water enters through tiny pores and circulates through the canals, the current being caused by many little waving structures in the canals. As the current passes through to the hollow center, the sponge absorbs food from the water. It is able to make this current flow rapidly or slowly, according to its immediate need for food.

The skeletons which support the jellylike masses of sponges are made of small pieces of calcium carbonate, the chief constituent of limestone. It has been estimated that in the formation of one ounce of this material, at least a ton of sea water must pass through a sponge.

Few animals relish the skeletons of sponges, and the fact that the sponge can give off poisonous substances is another protection. Some animals use sponges as a defense against their enemies. Hermit crabs, for instance, sometimes surround themselves with sponges. On the other hand, sponges are unwelcome neighbors for some animals. Oysters, whose food is much like that of sponges, may be starved to death if their shells become covered with sponges.

Sponge Fishing. Although sponges are found in many parts of the world, the most important commercial sponge fishing is in the Mediterranean, along the Florida coast, in the Bahamas, and in Cuba. Tarpon Springs, on the west coast of Florida, is the center of the largest sponge-gathering industry in the world.

Sponges must be gathered in fairly shallow water, usually no deeper than 125 feet. There are three methods of gathering sponges: by diving, by dredging, and by means of a long pole with a three-pronged fork. Divers who descend to the bottom wear rubberized suits and metal helmets. When sponges are taken with the long pole, one of the fishermen in the boat looks through a glass-bottomed bucket until he sights a desirable sponge; then he hooks it. In clear water it is possible to see through the glass-bottomed bucket to a depth of sixty feet.

SPONTA'NEOUS COMBUS'TION. Paper, cotton or woolen stuffs, and soot and coal sometimes catch fire when soaked with oils and when stored in places with little air. Ignition of this kind is called spontaneous combustion. See COMBUSTION.

SPOON'BILL. No relation to the shoveler duck, which also is known as a "spoonbill," the brightly colored spoonbill of the heron family is a beautiful but rare bird. Like its web-footed namesake, it has a long, spoon-shaped bill with which it shovels about the muddy river bottoms, scooping up small shellfish and insects. Spoonbills usually grow to a length of about thirty-two inches, are naturally shy, and live in remote rivers of warm climates.

The only American species is the *roseate*

VICTIM OF MAN'S LOVE FOR BEAUTY
Ruthlessly killed for his brilliant plumage, the roseate spoonbill is now seldom found, except in the remote Florida Everglades.

spoonbill, which has a pinkish body plumage and brilliant-red wings. The neck and upper part of the breast are snowy white. Spoonbills live in colonies, and on long flights assume a more or less symmetrical flying formation. They usually return to the same breeding places year after year. Because of the demand for their gorgeous plumage, the roseate spoonbill has been nearly exterminated by hunters.

SPORE. When we break open a puffball it often sends forth a cloud of dust. This dust is made up of thousands, sometimes millions, of tiny cells, any one of which is capable of growing up into another puffball plant. Such a cell is called a spore. It is not a seed, but a much simpler organism. Some spores are, in fact, merely small units of protoplasm, with a nucleus, but without any surrounding walls.

Spores are found on most of the lower orders of plants, from the algae to the ferns, and are also present in the higher plants. We commonly think of our familiar plants as being reproduced from seeds, but the seeds themselves are really tiny plants resulting from the union of two kinds of spores, one of which is pollen. See POLLEN; SEEDS.

SPOTTSYLVA'NIA COURT HOUSE, BATTLE OF. Characteristic of the stubborn struggle waged by Union and Confederate forces in the final year of the Civil War was the Battle of Spottsylvania Court House, May 8-21, 1864.

General Ulysses S. Grant had taken command of all the Union forces in February, 1864, and had proposed, as part of his plan, to fight his way to Richmond through the wooded region south of the Rapidan River, known as the Wilderness. On May 4 the Army of the Potomac, led by General Meade, crossed the Rapidan and encountered stout resistance from the Confederates under Robert E. Lee. The indecisive Battle of the Wilderness was fought on May 5 and 6. The Federal troops then proceeded southward in an attempt to take Spottsylvania Court House; but Lee, anticipating the move, occupied the site first. A bitter struggle ensued, lasting from May 9 to May 18, without any material gains to either side, but with a great loss of men.

It was during this battle that Grant told General Halleck, "I propose to fight it out on this line if it takes all summer." The cavalry raids of General Philip Sheridan were a notable feature of the battle. See CIVIL WAR IN AMERICA.

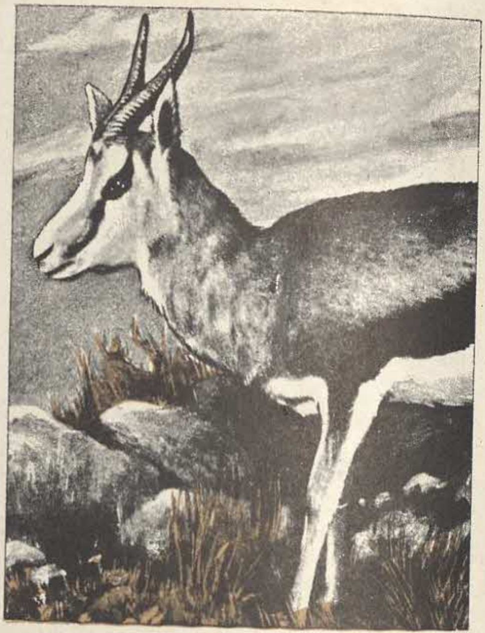
SPRAT. Distinguished by sharply notched lines along the abdomen, the sprat is a well-known European fish of the herring family. It is found in the North Atlantic, and in the Mediterranean. Sprats, which are rarely longer than six inches, are cured either in dry salt or brine and provide inexpensive and delicious food.

SPRING. To most people, spring means the awakening of plant and animal life to renewed activity, a period embracing the months of March, April, and May. Astronomically, in the Northern Hemisphere spring begins with the vernal equinox, when the sun is directly over the equator, and it lasts until the summer solstice, when the sun reaches its northernmost limit, the Tropic of Cancer. More exactly, it begins on or about March 21, when days and nights are equal, and lasts until June 21 (or thereabouts), the longest day of the year. With the approach of spring in the Northern Hemisphere, fall begins in the Southern Hemisphere, where the seasons are reversed. See EQUINOX; SOLSTICE.

SPRING. In the early days of America's founding, a cool, bubbling spring often determined the site of a pioneer settlement. Such springs are always fed from underground reservoirs, sometimes many miles away. These subterranean storage basins are built up as rainwater and melted snow sink through porous soil until they reach an impassable, nonporous layer of rock. Following along this layer of rock, the water sooner or later reaches an outcropping, and bubbles forth as a spring.

In some mountainous regions, the underground stream is forced along hot, volcanic rock and emerges as a hot spring. A mineral spring is formed when the water rises or descends through various strata and becomes charged with gaseous or mineral substances. Among famous mineral springs are those at French Lick, Ind., Saratoga Springs, N. Y., and Karlsbad, Germany. See ARTESIAN WELL.

SPRING. When an automobile passes over a bump in the road, the springs "give" and absorb the jolt, thus giving the passengers a smooth, comfortable ride. The efficiency of the automobile spring, or any spring, depends upon its elasticity and its ability to recover its original shape. Spiral springs, such as those in watches and clocks, are wound about a center and furnish their power by unwinding. Helical springs are wound in cylindrical form. They are used on the wheel trucks of railroad cars to reduce concussion. Laminated springs, like those of automobiles, are built up of flat, elliptical "leaves" of varying lengths. Though springs may be made of rubber, most of them are constructed of steel, brass, or phosphor bronze.

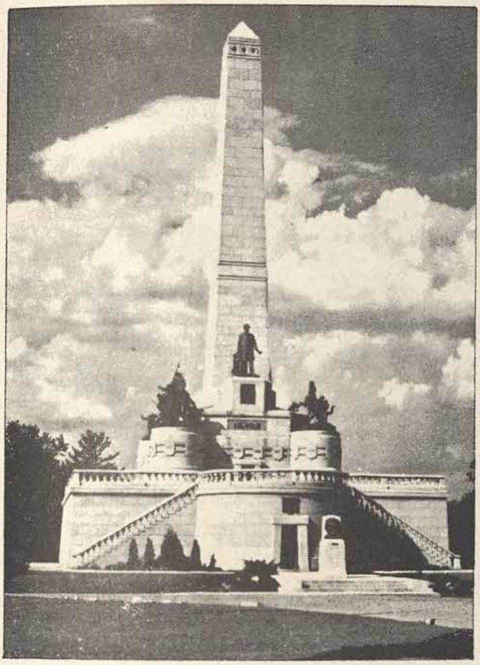


SOUTH AFRICAN HIGH JUMPER

A most interesting sight is the fleet-footed trek of the springboks to greener pastures.

SPRING BEAUTY. Among the earliest and daintiest of our spring flowers, the spring beauty possesses an advantage over many competitors for the honor of appearing early because it stores food in a tuber below ground, which is utilized as soon as the frost leaves the ground for the production of leaves and pale-pink flowers. The tuber, furthermore, protects the spring beauty against the thoughtless persons who pick wild flowers, because even if deprived of its first shoots, the tuber is still capable of sending up another plant. It is further protected by the fact that the flowers wilt soon after picking and they can seldom be persuaded to open again. Even in its native haunts in moist woods, the blossoms open only in the presence of sunshine. If the day is cloudy the petals remain closed.

SPRING′BOK. Capable of jumping or springing to a height of ten or twelve feet when alarmed or at play, the springbok of South Africa is aptly named. It is a graceful animal, slightly larger than the common deer, and has a long, delicate neck and legs and slightly-curving horns. The springbok is of a beautiful brown color above, with white under parts and head; its back is marked with a slender band of white. It is classed as a gazelle.

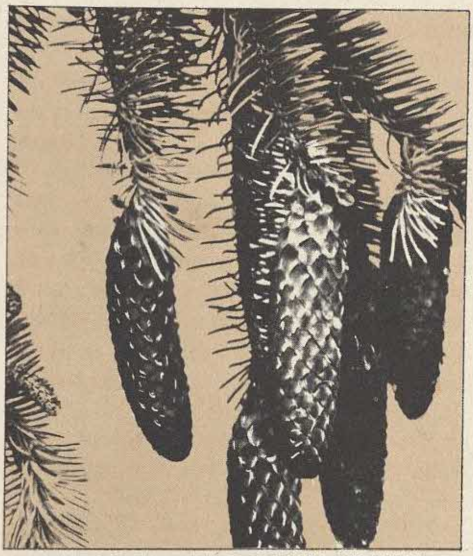


TOMB OF THE EMANCIPATOR

In this massive mausoleum at Springfield, Ill., lie the mortal remains of the "Prairie State's" greatest son, Abraham Lincoln.

SPRING'FIELD, ILL. The capital of Illinois, Springfield was the home of Abraham Lincoln when he was elected President. His home there and his tomb, in Oak Ridge Cemetery, are state-maintained. Nearby is New Salem State Park, a pioneer village restored to look as it did when Lincoln lived there as a young man.

Located some 185 miles southwest of Chicago, on the Sangamon River, Springfield is served by several rail and air lines, and by well-paved highways. It is a bustling wholesale and retail trading center for a rich, surrounding farming region, and the home of Illinois' outstanding annual state fair. The city's diversified manufactures include tractors, road-building machinery, steam boilers, garage equipment, electric meters, shoes, mattresses, and paints. Soybean processing and the making of stock feeds, flour, and other cereal products also are important. Large man-made Lake Springfield provides water, electricity, and recreational facilities for the city. The many business concerns having headquarters in Springfield include several insurance companies.



FRUIT OF THE LORDLY SPRUCE

The closely bunched, four-sided needles and graceful, tapering cones are characteristic of this evergreen giant of the forest.

Dominating the city is the dome of the capitol, which was started in 1868. The state also maintains a group of other buildings there, as well as its Historical Library, with its outstanding Lincoln Collection. Educational institutions in the city include Springfield Junior College and Concordia Theological Seminary.

Founded in 1818, Springfield became the state capital in 1837 and a city in 1840. Its population is about 84,000.

SPRUCE. Among cone-bearing trees, the spruce is one of the most valuable commercially. An evergreen, it resembles the pine. It differs from the pine, however, in several respects: its cones hang down, its leaves grow from woody projections on the branches, and its needles grow spirally around the branches. The bark, like that of the pine, is dark and scaly.

The most important of the European spruces is the *Norway* spruce, a beautiful tree which grows to a height of 150 feet. It has been successfully transplanted to North America.

Of the species native to North America, the most important are the *black* spruce, *white* spruce, *red* spruce, and *Sitka* spruce. The black spruce is especially valuable because of its lightness and strength and is often used in shipbuilding, the manufacture of ladders, and in the pulp and paper industry. The Sitka spruce is a giant, often reaching a height of more than 200 feet and a diameter of sixteen feet, and ranking next in size to the sequoias and redwoods. It is used for interior lumber, flooring, boxes, and in the manufacture of airplanes. Red and white spruce are used in making musical instruments such as guitars and violins. Spruce trees are also a source of resin, tar, and turpentine.

SPURGE FAMILY or EUPHORBIACEAE, *u for be a' se e.* A group of 4,000 herbs, shrubs, and trees which are widely used commercially. They give off a milky juice which is often poisonous if taken internally. One species, snow-on-the-mountain, has been used in branding cattle; it blisters the skin. Rubber, castor oil, croton oil, and cassava come from plants of the spurge family. Some spurges have bright flowers and some other spurges look like cacti.

SPUT'NIK, the name given to the first man-made satellites launched by the Russians. The word *sputnik* means *satellite* or *fellow traveler*. Sputnik I was launched in October, 1957. Sputnik II, carrying a dog, was launched in November, 1957. In May, 1958, Sputnik III was launched. See SATELLITE.

SPY. Probably the most dangerous profession in the world is that of a spy, whose duty it is to discover military secrets of enemy nations by deception. If either a soldier or civilian in disguise works his way into government or military circles in the enemy nation and obtains information valuable to his own government, he is a spy. Open reconnoitering by airplane or in the trenches is not considered espionage. If a spy is caught during a war and found guilty, he is usually executed. In spite of the hazards, however, spies are almost continually at work in nearly every country. Most countries maintain counter-espionage forces, people organized to discover and thwart the spies.

SQUASH, *skwosh*. Grouped among the cucurbits along with the pumpkin, melon, and cucumber, the squash is a familiar vegetable. Like the pumpkin, it has large leaves and yellow flowers. There are two kinds of squash—*summer* and *winter*. Summer squash, which grows on a bushy plant, is cooked as a vegetable before its outer shell has hardened. It is somewhat acorn-shaped and seldom exceeds a diameter of twenty inches. Winter squash, so-called because it can be kept, grows on a trailing vine, and is harvested in the fall. Squashes grow well in any rich soil; winter varieties must be planted at least eight or nine feet apart, because of the length of the vines.

SQUAT'TER SOVEREIGNTY, *sov'ur in ti,* **or POPULAR SOVEREIGNTY.** In American history, the doctrine of squatter sovereignty was a point of discussion during the slavery controversy before the Civil War, and was identified especially with Senator Stephen A. Douglas of Illinois. The term was applied to the doctrine that the people of a territory could decide for themselves whether slavery should be permitted or prohibited within the territory.

The Kansas-Nebraska Bill of 1854, sponsored by Douglas, applied this principle to the states to be formed from Kansas and Nebraska territories (see KANSAS-NEBRASKA BILL). Although this plan was intended to uphold the rights of slaveholders, it was unpopular in the South; and dispute on the question finally led to a split in the Democratic Party. See CIVIL WAR IN AMERICA; DOUGLAS, STEPHEN ARNOLD.

SQUID, *skwid*. This mollusk is a tube-shaped sea animal, with a horny shell and ten arms about its head. It is related to the cuttlefish and octopus. The squid has fins to drive it forward, but can also move backward rapidly by forcing water out of an opening beneath its head. When in

GROTESQUE MARINE INKMAKER
Protectively colored, the squid moves with uncanny speed when its finny prey approaches.

danger it throws out a cloud of an inky substance to conceal its movements. It also has the ability to change its color. The length of a squid may be from a few inches to fifty feet.

Squids are found near the surface of the ocean, often in large numbers. They are a valuable food for the Chinese and are sometimes eaten in America, but are more often used there for bait by fishermen.

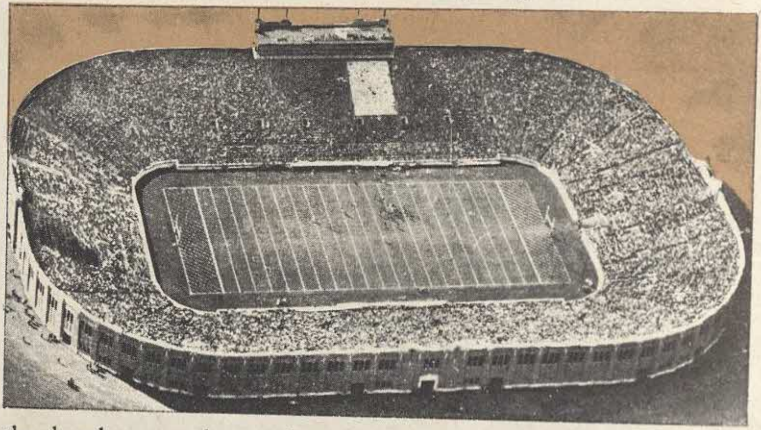
SQUILL. Growing chiefly in the Mediterranean regions, the squill is a bulbous plant of the lily family, and is also known as the *sea onion*. It is identified by its spreading perianth and three-cornered seed capsules. The outer husk of the squill bulb is dry, scaly, and of little value, but a syrup prepared from the inner part was formerly used in the treatment of croup and bronchitis. It has been largely replaced by other remedies less irritating to the heart, stomach, and intestines.

SQUIRREL, *skwur′el*. Few animals make so strong an appeal to young and old as do the active, graceful climbers we know as squirrels. They are gnawing animals, or rodents, and belong to the same family as woodchucks and chipmunks. One or more species occur in nearly all woodlands found in the United States. Among the more common and best known are the *red* squirrel, or *chickaree,* the *gray* squirrel, the *fox* squirrel, and the *Abert* squirrel of the Southwest. The flying squirrels are also widely distributed, though less often seen.

ENERGETIC NUTCRACKER
With an eye to the future, the untiring squirrel stores away food and nuts in his snug, arboreal home. Though wary, he is easily tamed.

Characteristics and Habits. The red squirrel, or chickaree, is a small form found in the Northern states and in Canada from the Atlantic to the Pacific coasts. There are several geographic races represented in this range. Red squirrels, notwithstanding all their graceful and amusing ways, are seriously harmful to bird life, persistently robbing nests of eggs and young birds. They are the only species of squirrel that offends in this regard and hence should never be permitted to increase in number to any great extent.

The gray squirrel occurs in the Eastern states from New York and New England to the northern part of Florida. It extends westward to Minnesota and Eastern North Dakota and generally to the edge of the Great Plains region south to Oklahoma. A number of geographic races of this interesting squirrel are recognized. They are popular in city parks and add much lively interest as they scamper about the ground in search of nuts, climb about the trunks and branches of trees, or come to feed from



HOME OF THE FIGHTIN' IRISH

In this large open-air bowl in Indiana, teams of the University of Notre Dame have written many thrilling chapters in football history. Most American universities and many cities and baseball clubs have similar stadiums, some of which can seat well over 100,000 spectators. This stadium seats 56,000.

the hand or perch on the shoulders of those who stop to play with them.

The fox squirrel is a fine, large, reddish-colored species found in woodlands of the Mississippi Valley from Louisiana to South Dakota.

The flying squirrel differs from all other squirrels in having the front and hind legs joined by folds of skin along the sides of the body, which, when outspread, act as a parachute as the animal leaps from a tree top and sails gracefully down to the foot of an adjoining tree. There are several species in the United States and Canada, but all of them are nocturnal in habit and so are rarely observed.

A great and interesting variety of habits and calls or notes may be found among these vivacious, sprightly creatures which will well repay one for hours spent in studying their ways in their haunts among the trees. They have many habits which are more or less common to all species. Their winter nests may be found snugly hidden away in hollow tree trunks or similar protected situations. These nests are lined with sticks and leaves to make them cozy and warm. As spring approaches, a large leafy nest is placed securely in a high crotch along the trunk or limbs of some tree. Squirrels are models of thrifty foresight in laying by winter stores of nuts, pine cones, and other edible products of forest and cultivated fields. Frosty mornings and ripening nuts should ever be associated with squirrels busily engaged from morning to night in stocking their storehouses ready to be drawn upon during the snows of winter.

STA'DIUM. Great edifices of stone and brick, seating thousands of persons, have been built in large cities and colleges for the holding of such athletic contests as football games, track meets, and boxing matches. These structures are stadiums. Their name commemorates the stadium erected at Olympia, Greece, for the ancient Olympic Games. This stadium had an elliptical track 606 feet, nine inches around, a building at one end for the athletes, and tiers of seats for the spectators. At Athens there was also a stadium which was restored in 1896 for the revival of the Olympic Games. Many of the great stadiums of America are modeled after these Greek structures, but others resemble the Roman amphitheaters.

STAFF. In order that the commanding officer of an army in the field may be relieved of many of the details of the campaign, he is assisted by a competent staff of officers. These men have no direct command of troops, but devote their full time to executive and administrative duties in connection with the various departments of the army; they also serve in an advisory capacity. Similar organizations assist the commander of a fleet, an air force, or other unit in times of war. See GENERAL STAFF.

STAG. For centuries, stag hunting has been one of the world's most thrilling sports. The name stag is applied to the males of many species of deer; more specifically it refers to the male of the red deer, after he has attained the age of five years and has a fully developed set of branching horns. The female is known as a *hind;* the young, a *calf*. Old stags, which usually travel alone, are called *harts*.

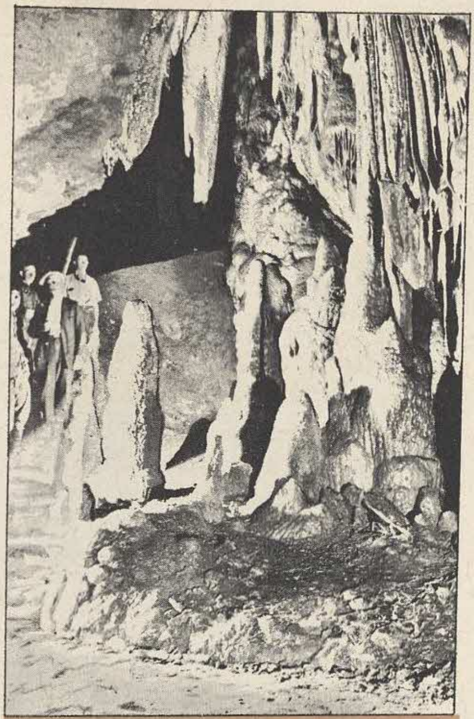
Stags often stand four feet high at the shoulders. Their graceful antlers, sometimes three and a half feet long, are shed each year after the breeding season. If the stag is angered or pursued, these sharply pointed antlers become dangerous weapons. Red deer are reddish only in winter; in the summer they assume a yellowish-brown color. They travel in herds, feeding upon grass, shoots, and young trees. See DEER.

STAG BEETLE. So-named because of the antler-like appearance of the mandibles of the male, the stag beetles form a family of nearly 750 species. The enormous jaws and horny, curved pincers of some species are nearly as long as the body. The giant stag beetle of the Gulf states and the common *pinching bug,* often found in decayed wood and sawdust, are well-known species. The female's jaws, though much smaller than those of the male, are, like the male's, fitted with teeth.

Stag beetles lay their eggs under the loose bark of trees; the larvae appear as small white worms. They feed upon leaves and decayed organic matter.

STAINED GLASS. The exquisite stained-glass windows of the modern church are distinctly different from those which were used in early places of worship. Stained glass was first used in pictorial designs about the ninth century. The colored glass was given its hue in the molten state, later being cut into pieces and held in place by plaster. Eventually, strips of lead replaced the plaster "binder." The earliest existing reference to pictorial stained glass is to that installed when the cathedral at Reims was rebuilt in the last half of the tenth century.

Today, largely through the efforts of John La Farge and L. C. Tiffany, a much superior method is used. Glass to be stained is made in graduated thicknesses, thus producing a shaded effect. Colored glass is then fused into the surface of large plates of the colorless glass, producing rich, but somewhat opaque, effects. By this method, no lead stripping is necessary.



ADAMANT ICICLES

Sparkling with subtle luminosity are these dripping stalactites of the "Hunter's Lodge," in picturesque Shenandoah Caverns, Virginia.

STALACTITE, *sta lak' tite*. Appearing like giant icicles, stalactites are calcium-carbonate or other mineral formations which hang from the roofs of caves. They originate from drops of limestone-bearing water which drip through the roofs of caves and form on the ceilings. On evaporating, the water leaves behind the solidified limestone. As new drops of water evaporate, the stalactite grows, often to great length and size. Some of the drops of water also fall to the floor, where, on evaporating, they cause a similar formation, or a *stalagmite,* which is built up from

MARSHAL STALIN
Dictator of Russia.

the floor of the cave. These two masses sometimes join to form a pillar. Similar structures are often seen hanging from stone bridges, while in many lava caves shining black stalactites and stalagmites are formed of basalt. See CAVE.

STALAG'MITE. See STALACTITE.

STALIN, *stah' leen,* JOSEPH (1879-1953). Virtual dictator of 193 million people, Joseph Stalin was the General Secretary of the Communist party of Russia. Inasmuch as the Soviet government is controlled by one party, the Communists, Stalin made his post the most important office in the Soviet Union.

Stalin was born Joseph Dzugashvili, the son of a peasant shoemaker of Georgia, in the Caucasus. He studied for a short time in a theological seminary, but early joined the Bolshevist movement as a follower of Lenin. He worked for the movement within Russia and was imprisoned and exiled for his political activities, the last time from 1913 to 1917. In the revolution that followed, he was Lenin's lieutenant, and after Lenin's death in 1924 he became the leader of the Bolshevist movement.

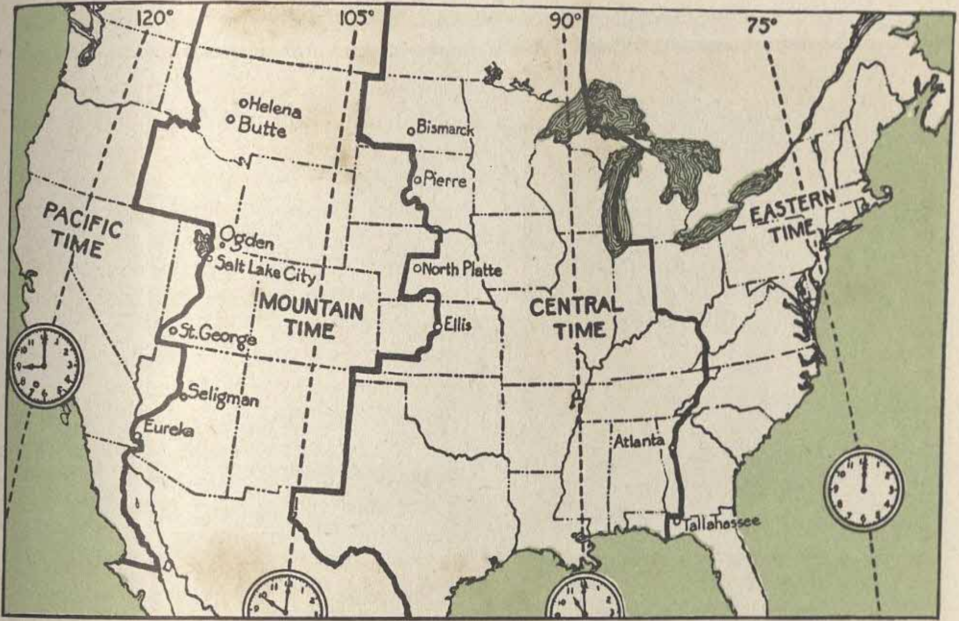
Stalin broke with Trotsky, Rykov, and other powerful leaders on the issue of world revolution. Believing that it was more important to make Russia self-sufficient than to push the proletarian revolution in other countries, Stalin furthered a series of five-year plans designed to develop the resources and industries of the Soviet Union. Gradually, the U.S.S.R. became isolated in Europe until the rise of Hitler threatened Russia's security.

In August, 1939, Stalin concluded a nonaggression pact with Germany; it was, however, nullified in July, 1941, when Germany invaded Russia. Stalin became Premier of the U.S.S.R. in May, 1941, and, during the war, as president of the State Committee of Defense, directed the Russian army and navy against Hitler. He retained his power in the post-war years. See UNION OF SOVIET SOCIALIST REPUBLICS.

STAMP. Used to indicate the payment of a tax, stamps usually take the form of pieces of paper, printed or embossed on one side, and are made in various denominations to fit the needs of the revenue act involved. One side of the stamp is gummed, so that it may be easily attached to the documents or commodities to be assessed. Under American internal-revenue laws, such stamps are required on cigarettes, tobacco, liquors, playing cards, and several other products. See INTERNAL REVENUE; POSTAGE STAMPS.

STAMP ACT. Following the close of the French and Indian War in 1763, Great Britain was responsible for a considerable debt, much of which was accumulated in the defense of the colonies. Believing that the colonies should bear a part of this burden, Parliament in 1765 passed the Stamp Act, providing for duties on various legal and commercial documents, newspapers, books, almanacs, calendars, and other articles. The colonies were required to buy stamps, which were affixed to the taxable articles.

Although the colonies were willing to help finance the war, they steadfastly maintained that Parliament, in which they were



HOW OUR NATION IS DIVIDED INTO STANDARD-TIME ZONES

Theoretically, the limit of each zone should be a straight line, but to avoid inconvenience, the time boundaries are zigzagged in many places. Those cities using daylight-saving time in the summer adopt the time of the adjacent zone to the east.

not represented, had no right to levy the tax. Rioting took place, the agents were compelled to destroy the stamps, and a formal protest was sent to the king and Parliament. Though the act was repealed the following year, it was one of the factors that led to the outbreak of the Revolution. See Revolutionary War in America.

STAND'ARDS, United States National Bureau of. Without the work of the National Bureau of Standards, there would be great confusion in our use of measurements and measuring instruments. The maintenance of standards of measurements, however, is but a small part of the activities of the bureau. The calibration of electrical instruments, the chemical testing of hundreds of manufactured products, the analysis of organic materials, the designing and testing of scientific instruments, and the setting up of marketing standards are important branches of the service.

The Bureau of Standards was established in the Department of Commerce in 1901 to replace the old Office of Standard Weights and Measures. Located in the northwest section of Washington, D. C., it is headed by a director, who is assisted by a large staff of scientists and subordinates. Numerous laboratories are maintained and the scientific work of the bureau is organized under the following divisions: Electricity and Optics, Metrology, Heat and Power, Atomic and Radiation Physics, Chemistry, Mechanics, Organic and Fibrous Materials, Metallurgy, Mineral Products, Building Technology, National Applied Mathematics, Commodity Standards, Electronics and Ordnance, and the Central Radio Propagation Laboratory.

STANDARD TIME. Not so many years ago, a traveler going from New York to San Francisco was compelled to set his watch many times during the journey; and even then his timepiece was almost constantly in error. For, until late in the nineteenth century, every town reckoned its own time, noon being based on the appearance of the sun directly overhead. This system, known as sun, or local, time,

DOUGHTY LITTLE MILES STANDISH AT THE HEAD OF HIS ARMY

Though short of stature, the captain at Plymouth was not lacking in courage. Several times his forces staved off vicious Indian attacks against the struggling little Pilgrim settlement.

was particularly inconvenient for the railway and telegraph companies; and ere long it became apparent that some new time system must be devised.

Sir Sandford Fleming, a Canadian civil engineer, worked out a system of standard time which was adopted in 1883 by the railroads of Canada and the United States. It was not until 1918, however, that Congress passed legislation making standard time legal throughout the United States.

The United States is divided into four time zones: Eastern, Central, Mountain, and Pacific. The center of the Eastern belt is the 75th meridian, and the zone roughly embraces the area within 7½° on either side of this line. The Central zone has the 90th meridian as its center; the Mountain zone, the 105th meridian; and the Pacific zone, the 120th. Alaska's four standard-time zones are based on meridians 120°, 135°, 150°, and 165°.

Because the sun's rays are first visible in the Eastern zone, the time there is ahead of zones farther west. For example, when it is eight o'clock in the Eastern zone, it is seven o'clock in the Central zone, six o'clock in the Mountain zone, and five o'clock in the Pacific zone. Going eastward, the traveler loses an hour for each zone passed; going west, he gains an hour for each zone. The system, although at first opposed in smaller communities, is now used generally throughout the United States.

Canada uses the same time zones as those in the United States, in addition to the Atlantic zone, based on the 60th meridian, and the Yukon, which is based on the 135th.

The limits of time zones are shown on the map as irregular lines; this variation has been purposely made to avoid giving certain towns or small sections of states a time different from that of the remainder of the town or state. Standard-time zones for the world were established in 1884 by the International Meridian Conference held at Washington, D. C. See INTERNATIONAL DATE LINE; LONGITUDE AND TIME.

STAN'DISH, MILES (about 1584-1656). In the minds of Americans Miles Standish will always stand high as the fearless defender of the Plymouth Colony in its struggles against hostile Indians. Born in

Lancashire, England, he joined the English army in the Netherlands and, although not one of the Pilgrims, sailed with them to America on the *Mayflower* in 1620.

In 1625 Standish went on a special mission to England, but returned the following year and settled at Duxbury, Mass., where he died. He served not only as Duxbury's military leader, but for many years was its treasurer as well. A statue to his memory has been erected in the town. See ALDEN, JOHN.

STAN'LEY, HENRY MORTON, Sir (1841-1904). Explorer, author, and newspaperman, Henry Morton Stanley won world-wide eminence through his daring search for Livingstone. It was he, more than any other, who unraveled the mysteries of dark, equatorial Africa and made possible the development of Congo's vast resources.

Born in Denbigh, Wales, the son of John Rowland, Stanley was orphaned at the age of two. He shipped as cabin boy to New Orleans in 1859, where he was adopted by a merchant whose name he assumed. The young adventurer enlisted with the Confederate forces during the Civil War and was captured at the Battle of Shiloh. Following his release, he enlisted in the United States artillery. In 1868 Stanley joined a British expedition to Abyssinia as correspondent for the New York *Herald*. The next year, the paper sent him on the famous search for Livingstone, whom he found ill in the neighborhood of Lake Tanganyika, in 1871.

In another expedition to Africa, in 1874, as correspondent for the *Herald* and the London *Daily Telegraph,* Stanley explored the equatorial lake region and traced the course of the Congo River. To develop this rich region, he returned to Africa in 1879 under the sponsorship of the International African Association, which had been founded by the king of Belgium. Later, this vast territory became the Congo Free State. In 1886 Stanley marched to the relief of Emin Pasha, governor of the equatorial provinces of the Egyptian Sudan.

Stanley had become a naturalized citizen of the United States in 1862, but transferred his allegiance to England in 1895, and in that year became a member of Parliament. He was knighted in 1899. His best-known books are *How I Found Livingstone, Through the Dark Continent, In Darkest Africa,* and his *Autobiography.* See LIVINGSTONE, DAVID.

STARCH. When we plant a grain of wheat, we are planting a living substance which is surrounded by starch that will supply its food in the early stages of its growth. When we dig a potato, we do so to make use of the starch which the plant has stored away for its future use. And no matter what food we eat, if its source is a plant or an animal fed on plants, starch has had a share in nourishing it. Chemically, starch is a carbohydrate. That is, it is composed of carbon, hydrogen, and oxygen. Green plants are the original makers of all kinds of carbohydrates—starches and sugars (see CHLOROPHYLL; LEAVES).

What Starch Is Like. Pure raw starch is a white powder, without taste or odor. It cannot be dissolved in any liquid known; this is probably the reason why it is the material most frequently used by plants for the storage of surplus food. It can, however, be liquefied and converted into sugar by enzymes, as it is when we eat it (see *Starch in the Diet,* below).

Examined under the microscope, starch powder is found to be made up of granules which in any one kind of starch are much alike in size and shape. Thus, potato starch can be distinguished from cornstarch or cassava starch. These granules ordinarily contain but a small amount of water, but will absorb more, as they do when we soak rice. In hot water the granules swell until they disperse and form a paste. Dry starch will stand a much higher temperature. When we use a hot iron on clothes dampened with starch (commercially prepared so that it will dissolve in water), the heat changes the starch to the gummy substance called *dextrin,* and hardens it. For commercial purposes this substance is prepared from potato starch (see, also, DEXTRIN).

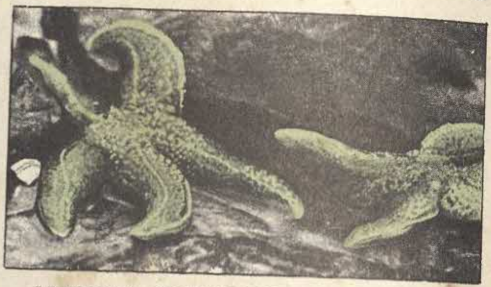
Starch in Commerce. Besides being present in potatoes, flour, rice, oatmeal, and other foods, starch is extracted for use in a number of ways. Cornstarch, cassava starch, sago, and tapioca are foodstuffs. Cornstarch, rice starch, and potato starch are used for laundering, for sizing paper and cotton goods, and for thickening colors and mordants used in textile printing. For these purposes, potato starch is superior to cornstarch, but the latter constitutes ninety per cent of the starch made in America.

Starch in the Diet. Starch is the chief source of energy after the first year of life. It is digested and absorbed more slowly than sugar. It is changed into sugar (glucose) in digestion.

If a potato is grated and the grated material put into a piece of cheesecloth and washed in a bowl of cold water, the material left on the cloth is the cellulose, or fiber, and the white mass that settles to the bottom of the bowl is starch. If a drop of iodine is added to a little of this starch, it will turn a deep purple blue. This is a common way of detecting starch in any food.

Starchy foods should furnish about one third of the energy of growing children after the second year. Starch, if not used as fuel in the body, may be stored as fat, thus increasing the amount of fatty tissue and body weight. See DIET.

STAR CHAMBER. Today we speak of "star-chamber" methods in describing autocratic and arbitrary use of power by a court, commission, or other authority. The name has its origin in the meetings of a tribunal established under the English Tudors, which met in a star-decorated room of Westminster Palace. The tribunal was made up of members of the Privy Council and certain judges, and it tried its cases, and sentenced those convicted, without a jury. The abuses of the Star Chamber Court became notorious, and it was abolished by the Long Parliament in 1641.



MORTAL ENEMY OF THE OYSTER
Sluggish inhabitant of the weedy sea bottom, the starfish is best eliminated by leaving him exposed to the hot rays of the sun.

STAR'FISH. The queer pentagonal creatures known as starfish belong to the "clean-up" squad of the sea, for their ambition seems to be to get rid of all garbage as quickly as possible. However, besides waste material, starfish will eat crabs, oysters, clams, and even young fish. Fishermen who catch starfish sometimes try to kill them by cutting them in two and throwing them back into the water. But each half of a starfish so treated may continue to live and grow into a healthy starfish, because the animal can renew parts of the body which have been destroyed.

If a captured creature is too large to get into the stomach of a starfish, the stomach may be brought out from the body and placed against the soft parts of the victim. In this way starfish can eat out the soft parts of oysters, though the shells of the oysters are too large to get into the bodies of the starfish. These animals are classed as echinoderms. See ECHINODERMS.

STAR'LING. Introduced into New York City in 1890, this European bird has spread rapidly throughout the states of the East and the Middle West. It is related to crows and to blackbirds. It is about eight inches long, black in general color, with some metallic reflections and with buff tips on many feathers, giving it a spotted appearance. The bill (in summer) is yellow. The bird stays the year round, spending much time on the ground walking about in search of cutworms, grasshoppers, and other insects. The injuries it causes come from a love of fruit

FEATHERED BRIGAND

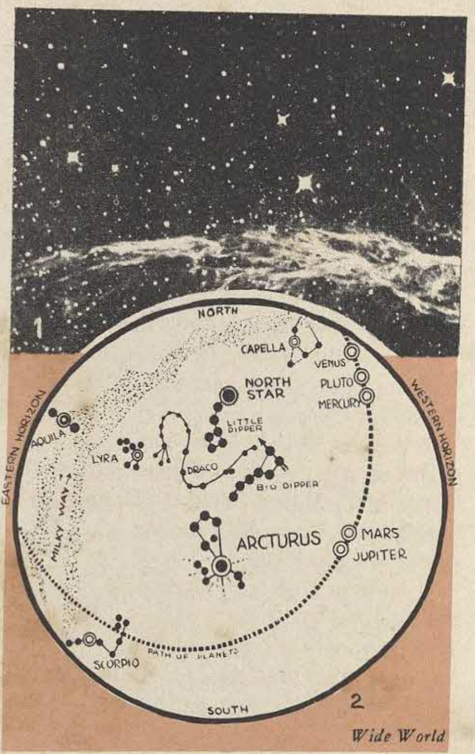
The quarrelsome, voracious starling—menace in America, a favorite in the British Isles.

and from its pugnacious habit of driving away native birds. The starling has a number of curious, confused notes mingled with clear whistles, and well imitates many other birds.

STAR OF BETHLEHEM. Native to Europe but widely distributed in the United States, the star of Bethlehem is a spring flower of the lily family which has white, waxy, starlike blossoms. It grows rapidly, infests lawns and pasture lands, especially in the Eastern and Central states, and is difficult to eradicate. Originally it was a garden flower.

STARS. Long before telescopes were invented, the ancients reflected upon the sparkling points of light which appeared in the sky on every clear night. Observant men saw that these heavenly lights seemed to hold fixed positions in relation to one another, and apparently revolved in groups around Polaris, the North Star. Hence they were called *fixed stars*.

The individual stars were given names, and their groupings, the constellations, were named, according to the beliefs and superstitions of the ancient peoples. The lore of astronomy was thus elaborated over a period of many centuries, during which men learned to steer ships and tell the time and the seasons by the movements of astral bodies. They even read destiny into the stars and so developed the pseudo-science of astrology.



Wide World

OUR CELESTIAL NEIGHBORS

(1) Telescopic photograph of stars. (2) Relative position of well-known constellations.

When the telescope enlarged the astronomical world, more was learned about the stars: their relative size and their distance from the earth; their probable composition, temperature, light-giving power, and density. It is realized now that the "fixed" stars are actually moving; they only appear fixed, because they are so far distant that they make the same sky pattern century after century.

It became evident that the stars were suns, like our sun but very much farther away and, in many cases, very much bigger. The star Arcturus, for instance, has a diameter twenty-four times as large as that of the sun; the diameter of Antares is 462 times as great. As soon as astronomers could measure the distances from earth to the stars, they realized that it would be difficult to express such vast spaces in miles. After the speed of light was discovered (about 186,300 miles per second), they began measuring star distances in *light years,* to avoid long, cumbersome figures. A light year is the distance light travels in one year at the rate of 186,300 miles per second.

The star nearest the solar system, Proxima Centauri, is 4.3 light years distant. In round numbers, it is 25,000,000,000,000,000,000 miles away from observers on earth. Light which started from the star Aldebaran at the time of the Battle of New Orleans, in 1815, had reached the earth at the close of the Civil War. When one realizes that light can flash around the world faster than seven times a second, the vastness of interstellar space is partially appreciated; yet astronomers tell us that there are millions of stars in the infinite reaches of space which are millions of light years from the earth.

Between 5,000 and 6,000 out of all the millions of stars are visible to the naked eye, but only about half of them can be seen at one time because only half the sky is visible to any one observer. Many more, of course, are observed with the telescope. Some are brighter than others; stars are ranked by *magnitudes* according to brightness: the brighter the star, the lower the number. Brightest of the dozen stars having a magnitude of under one is Sirius (-1.6). Only stars of the sixth magnitude or under can be seen without the aid of a telescope.

When two stars revolve about each other (that is, about a common center of gravity), we have the interesting combination of a double star. There are thousands of such pairs of stars in the heavens. In January, 1938, the largest known star in the universe was located through the telescope of the Yerkes Observatory, and was found to be the invisible companion of the double star Epsilon Aurigae. The companion star has a radius of about two billion miles, and it is 3,000 light years away. When stars fluctuate in brightness, they are said to be variable. Novae are "new" stars—heavenly bodies that suddenly burst into spectacular brightness and subsequently fade.

Stars differ from planets in that they shine by their own light, while planets reflect the light of the sun, about which they revolve. Seen through the telescope, stars appear as points of light; the planets appear as discs. It is because of their immense distances from us that stars seem to twinkle. Planets shine with a steady light.

For additional information, consult the following articles:

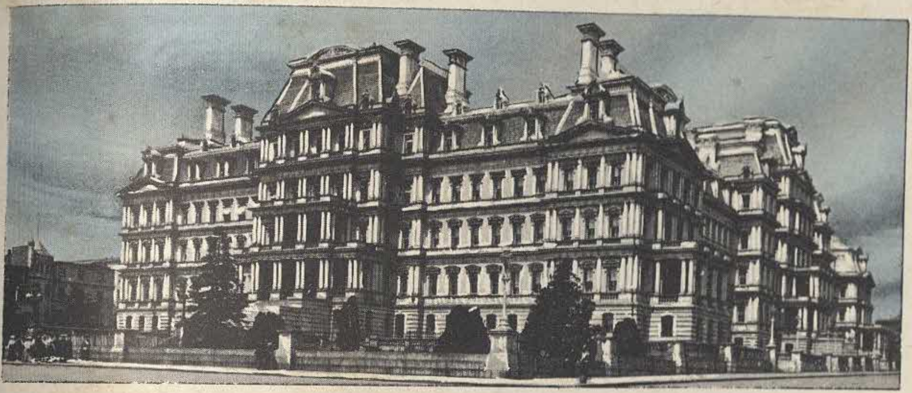
Astronomy
Constellations
Fixed Stars
Milky Way
Nebula
Planet
Spectroscope
Telescope

STAR-SPANGLED BANNER. Proudly hailing the triumph of "Old Glory" during the bombardment of Fort McHenry in a battle of the War of 1812, Francis Scott Key wrote his immortal song, *The Star-Spangled Banner,* in 1814. It was officially adopted as the American national anthem by an act of Congress in 1931.

Key, who was a lawyer in Washington, had gone aboard the British frigate *Surprise,* anchored in Chesapeake Bay, to secure the release of Dr. Beanes of Upper Marlborough, Md., who had been taken captive by the British during the invasion of Washington, D. C. Once on board, Key discovered that the vessel was preparing to bombard Fort McHenry, located near Baltimore, Md., and was thus forced to remain on board during the battle. The Americans watched the bombardment through the day and night of September 13-14. In the morning, the sight of the American banner floating over the ramparts of the fort moved Key to write the song. It soon became one of the most popular of all patriotic airs. The tune is from an old English song, *To Anacreon in Heaven.*

STATE. Traditionally, a state is a community of people within a given area, who have an orderly government which is supreme within that area. A true state, in the family of nations, recognizes no external authority higher than itself; that is, it enjoys external sovereignty.

Within the state there also may be internal sovereignty—either legal or political.



WHERE AMERICA FEELS THE PULSE OF THE WORLD
This picturesque structure at Washington, D. C., houses our oldest and most secretive executive service, the Department of State.

For example, in the United States the people are politically sovereign; and the government, controlled by the people, is legally sovereign.

There are numerous theories on the origin of the state, but it is generally agreed that the state grew out of man's social nature. At first the family was the governing group. Then developed the community group and finally the state, which took on the form that its members considered the best medium for standards of justice, maintenance of order, and protection.

In the United States each of the main political divisions making up the Federal Union is called a state. Actually, though, the Federal Union is the only real state.

States Within the United States. In theory, each state in the United States is sovereign in matters concerning its internal affairs. Questions outside its own domestic life are in the hands of the Federal Government. Its constitution is supreme insofar as it does not conflict with the Federal Constitution. Nevertheless, the Federal Government of the United States is sovereign and recognizes no higher authority in exercising the various powers which are under its control.

The states serve as a very important factor in governing a country as large as the United States. It would be almost impossible to govern so great an area efficiently from one point. By means of the states and the Federal Union of states, local efficiency and central authority are made possible.

STATE BANKS. See BANKS AND BANKING.

STATE, DEPARTMENT OF. The first executive department of the United States of America was the Department of Foreign Affairs created by an act of Congress in July, 1789. Two months later, on September 15, it was given additional duties concerned with home affairs, and was named the Department of State. It is the oldest of the executive departments, and the Secretary of State, who heads it, is generally considered the most important member of the President's Cabinet. He is appointed by the President, but his appointment must be approved by the Senate.

The Secretary of State negotiates all treaties with foreign governments, handles all diplomatic affairs, and serves as the medium of communication between the President and the governors of the states. Among the other duties of the Secretary of State are the custody of the Great Seal of the United States, countersignature of Presidential proclamations, and the issuance of passports and of warrants for the extradition of fugitives from justice. The Secretary also publishes all laws and resolutions of Congress, proclaims the final ratification of amendments to the Constitution, and transmits to Congress electoral votes of the states for President and Vice-President.

Some of the outstanding Secretaries of State have been Thomas Jefferson, under Washington; Daniel Webster, under Harrison, Tyler, and Fillmore; William H. Seward, under Lincoln and Johnson; John Hay, under McKinley and Theodore Roosevelt; Frank B. Kellogg, under Coolidge; Cordell Hull, under Franklin D. Roosevelt, and John F. Dulles under Dwight D. Eisenhower.

STAT'EN ISLAND. At the entrance of the harbor of New York is Staten Island, which is a part of Greater New York City. It is about thirteen miles long. The highest point, Todt Hill, is about 410 feet in altitude, and the island slopes to low salt marshes in the southwest. Forming the extreme southern point of New York state, the island is separated from New Jersey by Arthur Kill on the west and Kill van Kull on the north, and from Long Island by The Narrows. Staten Island constitutes Richmond County and the borough of Richmond, one of the five boroughs of New York City. The island contains many fine residential towns, among which are New Brighton, New West Brighton, Port Richmond, Stapleton, and Tompkinsville.

STATES-GENERAL. A general council or assembly which existed in France from 1302, the States-General was abolished at the time of the French Revolution. Its members included representatives of the clergy, nobility, and the common people, known as the Third Estate. The States-General met only when called by the king in times of emergency, and had little authority beyond endorsing the king's acts. There were no meetings of the body from 1614 until the historic meeting in 1789, which immediately preceded the French Revolution.

The legislative assembly of Holland is also called the States-General.

STATES OF THE CHURCH. See Papal States.

STATES' RIGHTS. The Constitution of the United States recognizes the existence of the several states and the Federal Union. Certain rights and powers are delegated to each, and those specifically not granted to the Federal government are recognized as states' rights.

Before the Civil War, many states declared themselves sovereign, with the right to nullify Federal acts, but the Civil War finally settled the issue in favor of the national government (see Secession).

It is generally conceded that states have jurisdiction over affairs within their borders which do not conflict with the rights and powers of the Union or other states.

STAT'UARY HALL. A spacious, semicircular, domed hall located on the first floor of the Capitol in Washington, Statuary Hall was dedicated in 1864 as a memorial hall to the great men and women of the various states. Each state can place a statue of its most illustrious citizen there; two statues were once allowed from each state. But when all were in the hall, the weight of the statues and the weakness of the foundations necessitated moving many of the figures to other parts of the building. This hall, until 1857 the chamber of the House of Representatives, has witnessed many historic events, such as the inauguration of President Madison in 1809 and in 1813, and the election of John Quincy Adams in 1824.

STEAM, *steem.* When water boils, it is being changed from a liquid to a vapor (see Evaporation). The vapor which results is steam. Like air, it is invisible. When we see a cloud at the spout of the teakettle it is not steam, but steam turned back again to water.

Steam is one of the most useful substances in the world. In the steam engine it has been the chief factor in transforming modern existence by the extensive development of machinery and the improvement of methods of travel and transportation. It is also important in the steam-heating system and in pressure cooking.

The Expansion of Steam. The story used to be told of how Jamie Watt, the Scottish miner's boy, saw the steam lift the cover of his grandmother's teakettle and dreamed of the day when he should harness this mighty force for greater things. And, 2,000 years before him, pagan priests had made steam open temple doors and perform other tasks.

In steam, as in any other vapor or gas, every particle of matter is in violent motion. The whole mass is trying to spread out and occupy more space, and exerts pressure which drives the steam engine.

If water is confined, as in the steam boiler, and heat continues to be applied, the pressure of the generated steam will rise. Each pound increase in pressure causes a definite increase in temperature.

This correspondence between increased heat and increased pressure is useful in a number of ways. It makes it possible to *superheat* steam for highly efficient steam engines. It is also a help in cooking by steam. In many hotels and restaurants, cooking is done with steam under a pressure of twenty-five pounds or more, so that the food will be subjected to very high temperature. Superheated steam is also used in rapid seasoning of wood. See HEAT.

STEAM ENGINE. Life has changed more in the past 150 years than it did in all the previous centuries. Much of the credit for this change belongs to the steam engine, a machine for converting the energy of steam into mechanical action, or that of motion.

Before the Industrial Revolution, the world was largely agricultural. There were no great factories and few large cities. Today, we find millions of people working in factories and a large percentage of our people living in cities. Iron and steel monsters roar along the rails in contrast to the horse-and-buggy transportation of a century ago. Fast, powerful ships now churn the water where the leisurely sailboat once held sway.

WATT LEARNS THE POWER OF STEAM

From this vague beginning came the creation of the steam engine and the dawn of a new era, the Industrial Revolution.

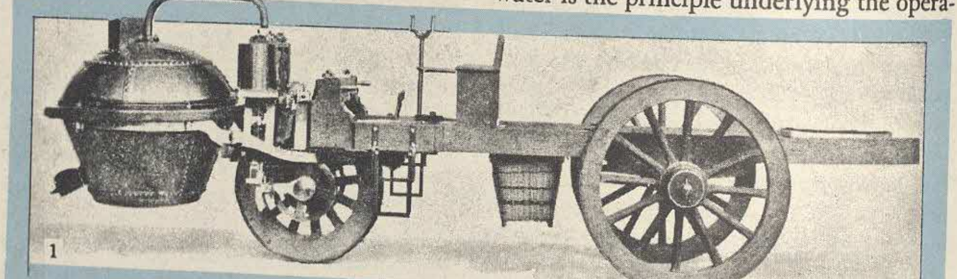
What has brought about this remarkable change? For many decades, it was the steam engine. And, indeed, this modern monster still serves man faithfully in the factory, and on land and on water, although in many cases it has been supplanted by faster, more efficient, and more economical motors and engines. The pumping of water to supply our cities and towns, the generation of electricity, that force of a thousand uses, the thrashing of wheat in our great Grain Belt—these are but a few of the uses of the versatile steam engine. In short, it has changed the ways of the world; it has drawn humanity closer together, brought the farm nearer the market, and has broken down the barriers that human drudgery and slow communication and transportation have erected. But in spite of its faithful service, the steam engine is on the wane and its duties are gradually being usurped by the gasoline engine, Diesel engine, electric motor, and steam turbine, all of which surpass it in efficiency.

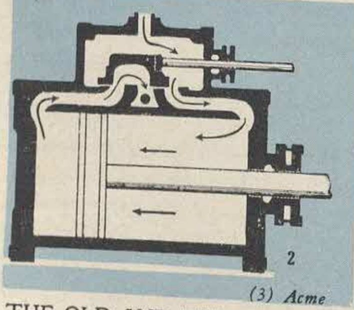
History of the Steam Engine. The steam engine is not a new invention, for as early as 130 B. C. Egyptian temple doors were opened and closed by crude machines operated by steam. But because of the plentiful supply of cheap labor, the steam engine seems to have been neglected, and did not again appear until about the middle of the sixteenth century, when a rude steamboat was invented by a Spanish sea captain. About 1698, Thomas Savery, an Englishman, brought out a practical engine that was used for several years for pumping water from British coal mines. Further improvements were added in the Newcomen engine, patented in 1705. Not until about 1769 did James Watt, a Scottish inventor, build the steam engine that proved to be the ancestor of the machines of today.

Even at best, however, Watt's engines were inefficient, for he was afraid to use steam pressure greater than seven pounds to the square inch; many of our modern engines operate on pressures exceeding fifty atmospheres, or approximately 450 pounds, to the square inch. The first practical steamboat was built by William Symington in 1802; that of Robert Fulton, appearing five years later, assured the success of steam navigation on water. Stephenson's *Rocket* of 1829 outdistanced several competitors in an early "locomotive" contest and thus became the forerunner of the modern railroad engine.

How Steam Engines Operate. Though steam engines may be of gigantic size, they are most commonly built in sizes of less than 500 horse power. They are designed for speeds from 100 to 500 revolutions per minute, and are reversible.

The fact that steam at 212° F. occupies a space about 1,300 times larger at atmospheric pressure than an equal weight of water is the principle underlying the operation of a steam engine. When the steam is confined, as it is in a boiler, the pressure mounts greatly and the steam may then be admitted through a valve into the cylinder of the engine. Here it forces the piston for-





(3) Acme

THE OLD AND THE NEW IN STEAM TRANSPORTATION

(1) Cugnot's steam lorry, 1763. Its speed was four miles an hour. (2) Cross section of steam-engine cylinder and steam chest, showing valve action. (3) Modern streamlined speedster of the rails. Of Canadian design, it is the world's largest streamlined locomotive, and has an over-all length, with tender, of more than ninety-four feet.

ward, and the power is transmitted through the piston rod and connecting rod to the flywheel, which evens the flow of power. Before the piston reaches the end of its forward journey, an exhaust valve in the rear of the cylinder opens, and on the return stroke most of the steam is exhausted from the cylinder. The simple two-cycle process is then repeated so long as the boiler supplies sufficient steam pressure.

Stationary engines are usually fitted with a governor, which automatically reduces the amount of steam admitted to the cylinder, thus cutting down the speed when the engine is running under a light load.

Consult the following titles for additional information:

Boiler
Eccentric
Locomotive
Tractor
Turbine
Watt, James

STEAM'SHIP. See Ship.

STEAM SHOVEL. Like a huge, hungry monster, the steam shovel sinks its steel teeth into the earth, carrying away great chunks of dirt and stone in its metal jaws. In the excavation of sites for buildings and in digging ditches and canals, the steam shovel saves the work of hundreds of men, reduces costs, and performs the task much faster than laborers could possibly do it. The economical, large-scale "strip" mining of coal and iron would be well-nigh impossible without the aid of the steam shovel.

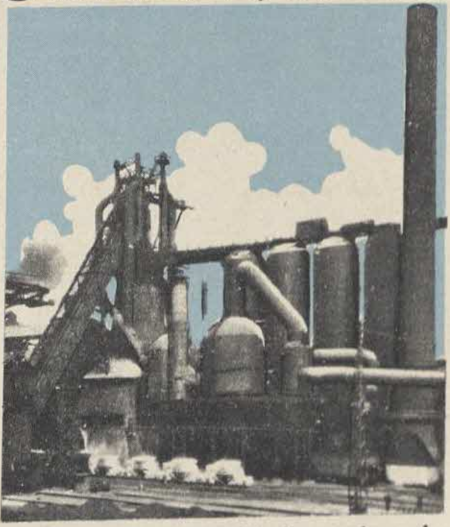
The machine consists of a swinging *boom* mounted on a rotating platform. The *dipper bucket,* or *scoop,* is attached to an arm which protrudes through the boom. Both boom and bucket arm may be raised or lowered by the operator at will, giving a wide range of excavating area. The mechanism is operated by steam. However, most power shovels are now run by an electric motor or Diesel engine. Some are operated from an overhead crane or railway car; but most are self-propelled, running on caterpillar treads or on wheels adapted to steel rails. Varying greatly in size, they can scoop from half a cubic yard to many cubic yards of material at each "bite."

STEAM TUR'BINE. See Turbine.

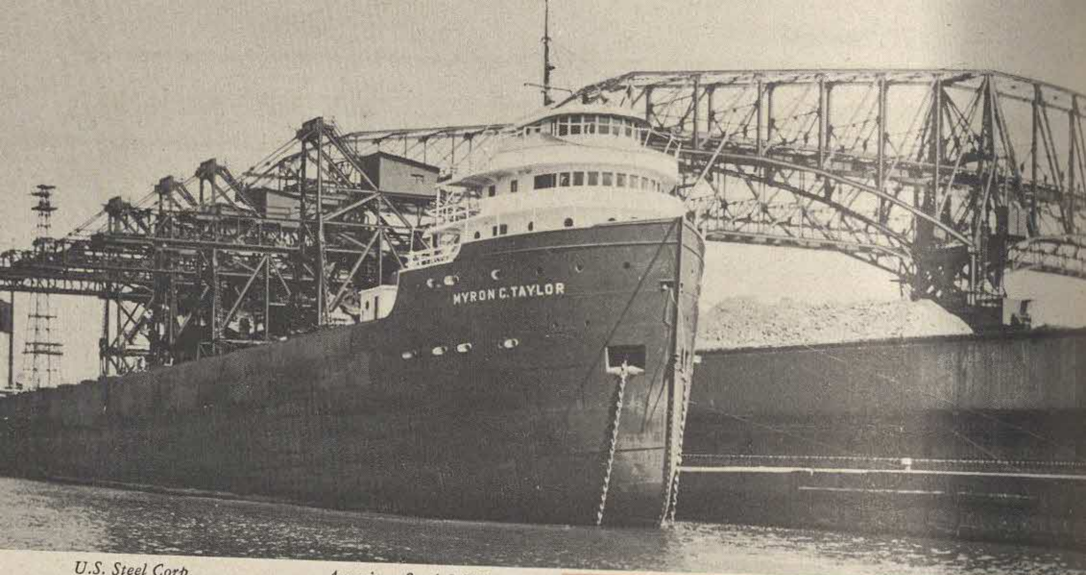
STEARIC, *ste ar'ik,* **ACID.** An odorless and tasteless fatty substance, stearic acid is found in animal and vegetable fats. It crystallizes in the form of pearly scales and is soluble in ether and partly so in alcohol. It is used with paraffin in making candles. It is also used in waterproofing materials, in varnish driers, and to thicken lubricants.

STE'ARIN. Most fats are mixtures of three *esters,* one of which is stearin, a combination of stearic acid and glycerine. It is found in large quantities in the hard animal fats such as tallow and suet. Lustrous white in color, stearin is soft but not greasy to the touch, and is insoluble in water, although it dissolves in hot alcohol and ether. It yields an oil used in the manufacture of butter substitutes. Stearin is also an important constituent of soaps and candles.

STEEL *LIFEBLOOD of INDUSTRY*



STEEL. Soaring, black smokestacks reaching high above the mill; rows of tall blast furnaces whose fiery flames cast a glow over the night sky; white-hot rivers of molten iron and alloys flowing from hearth and furnace to be rolled, beaten,



U.S. Steel Corp. *American Steel & Wire Co.*

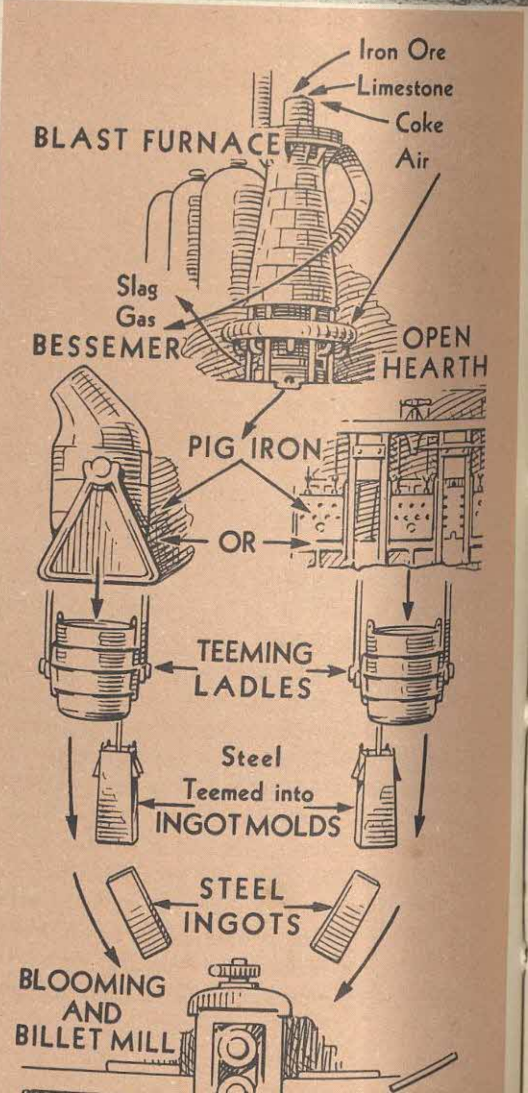
FROM IRON ORE TO STEEL RODS

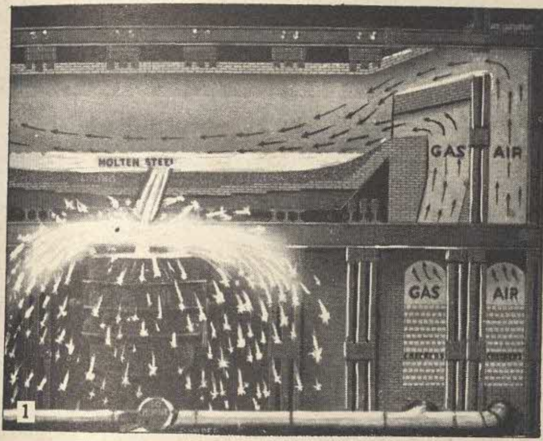
Giant ore boats, like the one above, bring ore from the iron mines to the giant steel mills located around the Great Lakes. At right is a diagram of the process by which the ore is converted into steel rods.

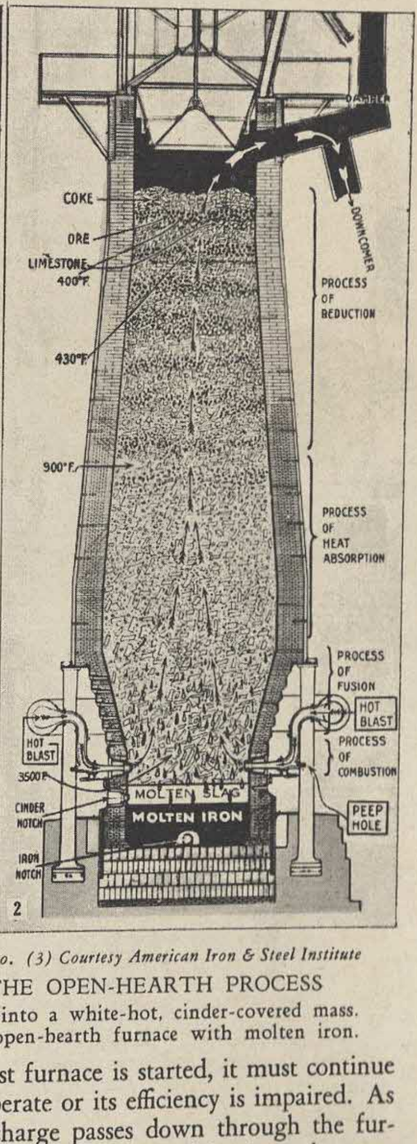
and molded into a myriad of articles—these are the cradles of steel, monuments to an age that owes its existence to metal. In some countries steel production is considered an index to the state of business.

Steel Manufacture. Steel is iron that contains from one-half per cent to two and one-half per cent carbon. It is stronger than the iron from which it is made and can be hard or soft, strung into fine wires or rolled into sheets, cast into blocks or formed into accurate scientific instruments. To make steel, the iron ore must first be smelted in a blast furnace. This device is a tall, cylindrical structure, into which a blast of hot air is sent to produce temperatures of 2,800° to 3,000° F. It consists of the *stack;* the *bosh,* or conical portion under the stack; the *hearth;* the *charging hopper;* and the *tuyeres.* The stack is made of plate steel and is lined with firebrick to prevent radiation of the intense heat. Firestone or firebrick line the bosh. The hearth is constructed of large blocks of firebrick to resist the heat.

On top of the blast furnace is a gallery where the materials for the charge are







(1, 2) Courtesy American Steel & Wire Co. (3) Courtesy American Iron & Steel Institute

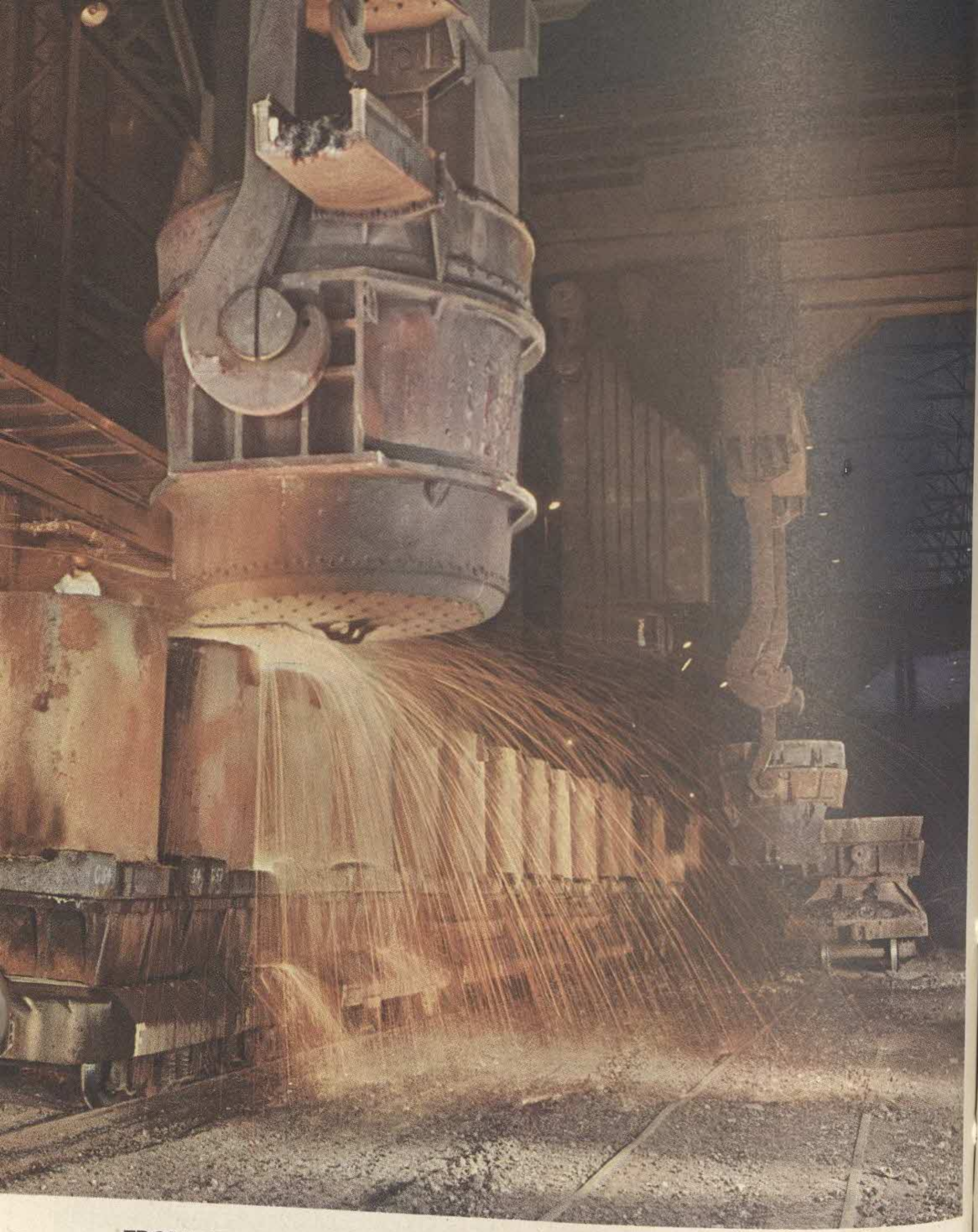
HOW MOST OF OUR STEEL IS MADE—THE OPEN-HEARTH PROCESS

(1) Hot gases are burned above the iron, turning it into a white-hot, cinder-covered mass.
(2) Cross section of blast furnace. (3) Charging open-hearth furnace with molten iron.

brought to be dumped down the stack. The top is closed and opened through a bell-and-cone arrangement operated by machinery. The blast is furnished by tall, cylindrical structures called *stoves,* usually four in number, which are adjacent to the furnace. These stoves heat the gas generated by the furnace and drive the air into the furnace to increase the temperature.

The charge consists of iron ore, coke, and limestone. The limestone, when heated, combines with the other substances in the ore, leaving the iron itself free. The charge is repeated continually, for; once a blast furnace is started, it must continue to operate or its efficiency is impaired. As the charge passes down through the furnace, the limestone and foreign substances form slag which floats on top of the iron and which is drawn off through an opening in the furnace. The molten metal is drawn off through another opening. This metal forms the pig iron which eventually becomes steel or wrought iron.

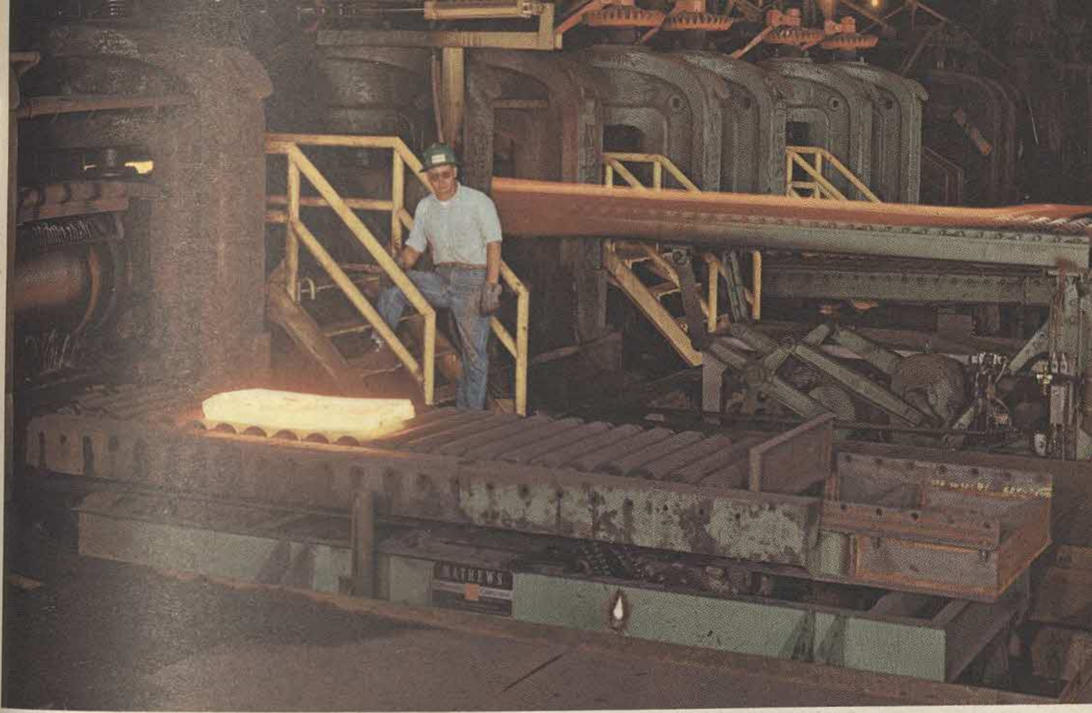
In the United States most of the steel is manufactured by the open-hearth method. The furnace is saucer-shaped and is made of brick reinforced with steel. The hearth



U.S. Steel Corporation

FROM THE HEARTH AND THE HEART OF THE STEEL INDUSTRY

The great furnaces, kept hot and banked even when the rest of the operation is closed down, might well be called the "heart" of the steel industry. From these furnaces the molten steel is drawn off into huge ladles, carried on overhead cranes. Standing in rows on rail cars are the ingot molds into which the molten metal is poured. As a ladle passes over the molds it releases enough steel to fill each mold, as shown above. The ladle is then returned to the furnace for another draw of molten steel, and the load of ingots is moved away to be allowed to cool.

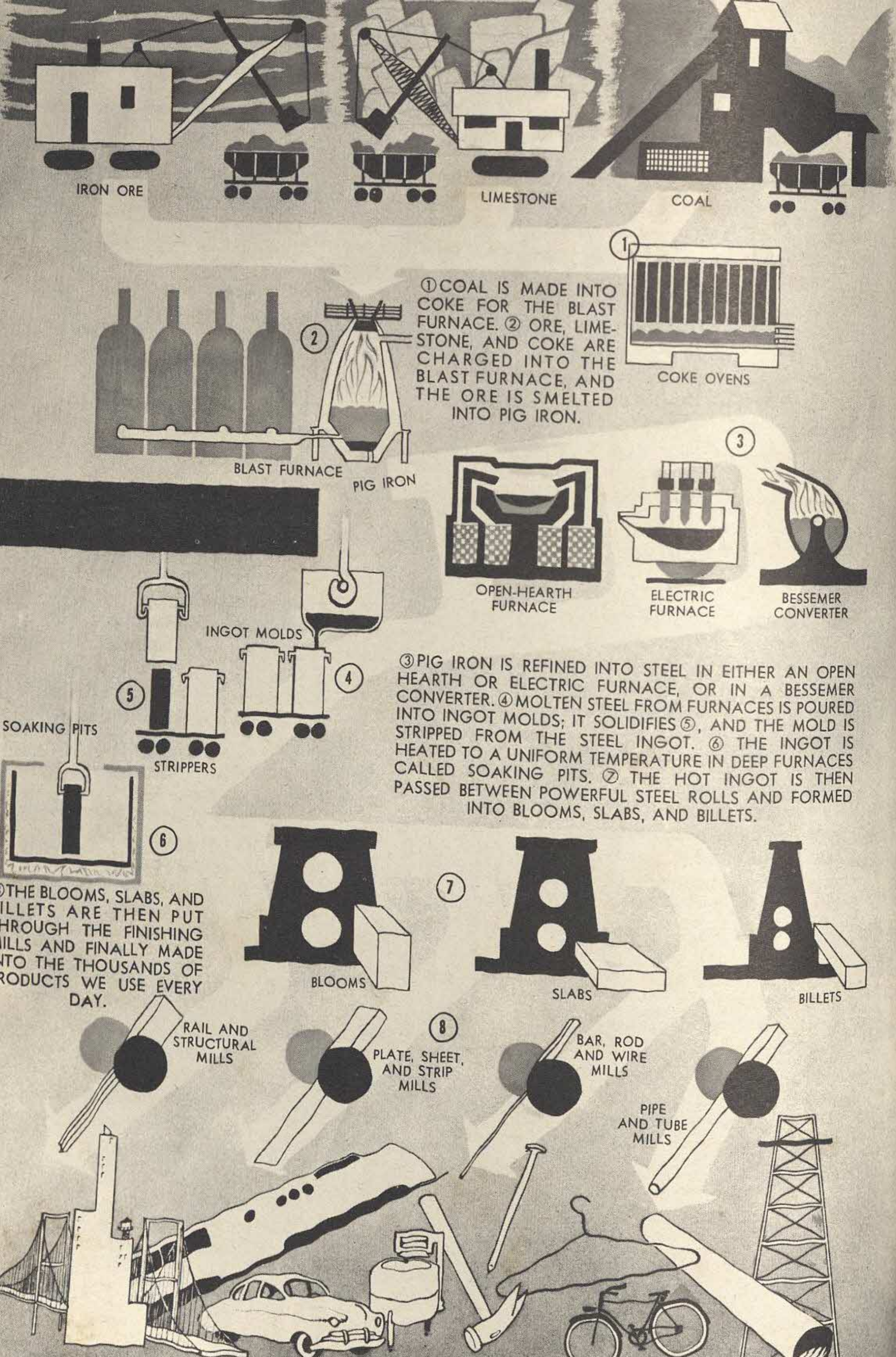


Ingersoll Steel Division of Borg Warner Corporation

HOW MAN SHAPES STEEL FOR HIS USES

Steel is treated in a great many ways including rolling, drawing, and extruding. Above, a rolling mill in which the heated ingots are passed between heavy rollers to form blooms, slabs, or billets. These are then finished to make a variety of products such as the color-coated roofing of a church, right. Such steel panels are also used in exteriors and interiors of many different types of structures.

National Steel Corporation



①COAL IS MADE INTO COKE FOR THE BLAST FURNACE. ② ORE, LIMESTONE, AND COKE ARE CHARGED INTO THE BLAST FURNACE, AND THE ORE IS SMELTED INTO PIG IRON.

③PIG IRON IS REFINED INTO STEEL IN EITHER AN OPEN HEARTH OR ELECTRIC FURNACE, OR IN A BESSEMER CONVERTER. ④MOLTEN STEEL FROM FURNACES IS POURED INTO INGOT MOLDS; IT SOLIDIFIES ⑤, AND THE MOLD IS STRIPPED FROM THE STEEL INGOT. ⑥ THE INGOT IS HEATED TO A UNIFORM TEMPERATURE IN DEEP FURNACES CALLED SOAKING PITS. ⑦ THE HOT INGOT IS THEN PASSED BETWEEN POWERFUL STEEL ROLLS AND FORMED INTO BLOOMS, SLABS, AND BILLETS.

THE BLOOMS, SLABS, AND ILLETS ARE THEN PUT HROUGH THE FINISHING ILLS AND FINALLY MADE NTO THE THOUSANDS OF RODUCTS WE USE EVERY DAY.

is lined with dolomite, which acts as a base. Gas, oil, or powdered coal is used for fuel. Pig iron, scrap steel, and limestone are then poured into the hearth. Upon heating, the carbon is oxidized and, as it escapes from the charge, the molten metal appears to be boiling. Other oxides in the mixture unite with the limestone and form a slag which rises and is drawn off. Tons of molten metal are run off from one charge. This product, now steel, is hardened into ingots. The next step is in the soaking pots, where the steel is heated with other ingots until it acquires a uniform solidity and temperature. It is then rolled, cast, or prepared for the purpose desired.

In the Bessemer process of steelmaking, huge batches cannot be made and scrap steel cannot be used. It is not as widely used as the open-hearth process. The converter in the Bessemer process is a pear-shaped, silica-lined crucible. Molten cast iron from the blast furnace is run into the converters, an air blast is turned on, and as air bubbles rise in the molten iron, the carbon and silicon are oxidized. The oxidation is completed in about ten minutes. The desired amounts of carbon, manganese, and other elements are then added and the contents of the converter poured into ingot molds. When iron contains much phosphorus or sulfur, a basic Bessemer process is used and basic slag is a by-product. Steel also is made in electric furnaces. Another method is to place wrought-iron bars between layers of charcoal in crucibles, exclude the air, and heat the iron to a yellow color (see ELECTRIC HEATING). The highest grade steel is made by this process.

Alloys. Steel is alloyed with various metals to improve its hardness, its machinability, and resistance to corrosion. Stainless steel, containing chromium and nickel, is used in kitchen utensils, in industrial and scientific equipment, and in building materials.

Also consult the following articles:

Alloy
Annealing
Bessemer, Henry
Chemistry
Iron
Tempering

STEEL'YARD. The steelyard has been changed but little since its use in early Roman trade. A variation of the old Egyptian balance, it consists of a long steel bar divided into two unequal parts by a hook, so arranged that the device may be suspended. The commodity to be weighed is attached to the short arm, and sliding weights are moved out on the longer arm until the two ends balance. By reading along the graduated scale on the long arm, one may ascertain the weight of the commodity. The platform scales so generally used today are built on the same principle as the steelyard.

STEFANSSON, *sta'fahns sohn,* VILHJALMUR (1879-). Among the great explorers who reached the Polar regions was Stefansson, discoverer of a number of large islands in the Arctic archipelago. Born in Manitoba, Canada, of Icelandic parents, he received his education at the universities of North Dakota and Iowa and at Harvard. After numerous research expeditions to the Arctic, he was dispatched by the Canadian government in 1913 to explore the northern shores of the Dominion. Early in 1914 his best ship sank, carrying some of the crew to their deaths.

Despite this loss, Stefansson pushed northeastward from Alaska across the treacherous ice packs of the Arctic Ocean by sledge; early in 1915 came his discovery of Borden, Meighen, Lougheed, Brock, and several smaller islands, rugged areas lying to the northeast of Prince Patrick Island. Among his outstanding books are *My Life with the Eskimos, The Northward Course of Empire, The Friendly Arctic,* and *New Compass of the World.*

STEINMETZ, *stine'mets,* CHARLES PROTEUS (1865-1923). A hunchback with a truly great intellect, Charles Steinmetz probably added more to the world's conquest of electricity than any other man, with the exception of Thomas A. Edison. Born in Breslau, Germany, he was educated at the University of Breslau, where he became an ardent socialist. He later studied in Berlin and Zürich, Switzerland.

Steinmetz came to America in 1889, and four years later joined the research laboratories of the General Electric Company at Schenectady, N. Y., where he remained until his death. From 1902 he held a professorship at Union College in that city. A true socialist, he refused any compensation other than living expenses.

Steinmetz was a genius in the mathematics of electricity, and contributed greatly to the industrial applications of electricity and magnetism. He wrote several books on electrical subjects, all of them notable for their clarity of phrasing.

STEMS. Prominent in the structure of a plant is the stem to which all other parts are attached, and from which they spring. The root does not send up the stem; the stem sends down the root, and that is its very first work. It may then, if it is the stem of a large plant, send out branches, which are but secondary stems, and these branches in their turn produce leaves and flowers. All of the plant food taken from the soil by the roots is carried by the stem to the leaves, and any injury to the stem which causes the closing of this channel results in the death of the plant. After the leaves have done their work on the substances thus brought to them—exposing them to the air and light, and changing them into the sort of food which the plant can assimilate—the stem receives this food and carries it to the various parts of the plant.

But the stem is not always merely a channel—it frequently has a work of its own to do, besides supporting the leaves and branches. Herbaceous stems—that is, green stems which are not woody but which die down to the ground every year—help the other green parts of the plant in turning the water and soluble salts taken from the soil into plant food. Other stems store food and moisture, and sometimes keep the plant alive for months when no new plant food is being manufactured.

Most of these "storehouse stems" are of the underground type. Because they do not appear above the ground, they are frequently confused with roots, but there are many signs which make it clear to the plant student that they are true stems, of modified form. The tuber of the Irish potato or the onion bulb is such an underground stem; but the sweet potato is a root, and not a stem. See ROOTS.

STENOG′RAPHY. See SHORTHAND.

STEPHEN, *ste′ven* (about 1097-1154). Despite eighteen years of almost incessant warfare waged in the defense of his crown, Stephen, last of the Norman rulers, reigned less than a year as undisputed king of England. The son of Stephen, Count of Blois and Chartres, and Adela, daughter of William the Conqueror, he became a great favorite of his uncle, Henry I. In return for his pledge to assure the succession of Matilda, Henry's daughter, Stephen was granted large estates in both England and Normandy. Nevertheless, upon Henry's death, in 1135, he returned to England, claimed the throne, and was crowned in London.

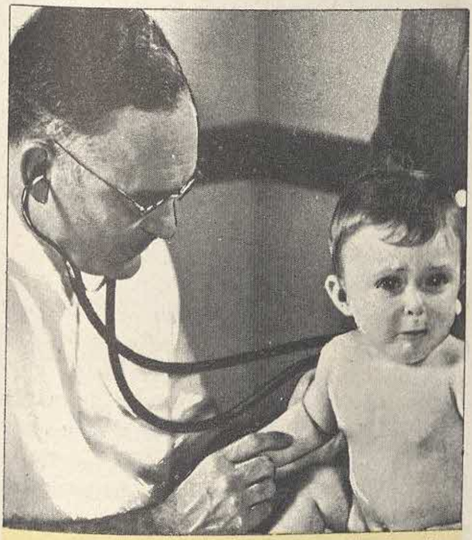
Revolts immediately flared, and in 1138 Stephen was forced to defend himself against David I of Scotland, who interceded for Matilda. The following year, England was invaded by the forces of Matilda and Robert of Gloucester, and there ensued fourteen years of civil strife.

Stephen was captured in 1141, and for a year Matilda extended her harsh sway over the land. Meantime, Gloucester was captured, but was later exchanged for Stephen, and the war continued. After Matilda's departure in 1148, the war was carried to a successful conclusion by her son Henry and the Count of Anjou. Under the Treaty of Wallingford, signed in 1153, it was agreed that Stephen should retain the throne until his death, after which Henry should succeed to the crown. See ENGLAND.

STEPHENSON, *ste′ ven son,* GEORGE (1781-1848). The rapid transit of goods and people, the development of new lands, the growth of our industrial system—all these have come about largely because of the locomotive, an invention of George Stephenson. He was born at Wylam, England, and after a scanty education, became an engine maker at a Killingworth colliery. During his spare time, he invented a miner's safety lamp and developed a crude locomotive that was used at the mine.

In 1821 Stephenson became chief engineer for the Stockton and Darlington Railway, the first steam railroad to haul passengers and freight. He accepted a similar position with the Liverpool and Manchester Railway in 1824. His famous *Rocket* won a locomotive contest in 1829 with a speed of twenty-nine miles per hour, and was purchased by the railroad, which formally opened the following year. As a result of his success, Stephenson was in great demand as a consulting engineer. See LOCOMOTIVE; RAILROAD.

STEPPES, *steps.* Extending from Southeastern Europe eastward across the southern part of Russia and Siberia to the Altai Mountains, are the steppes, great, treeless plains. They are dry and barren during most of the year, but during the spring rains, grass becomes green and abundant and provides pasturage for the flocks and herds of the wandering Tatar tribes. See PLAIN.



Courtesy Californians, Inc.

MEDICAL "TROUBLE SHOOTING"
The stethoscope aids greatly in diagnosis.

STETHOSCOPE, *steth' o skope.* Physicians wishing to hear various sounds within the body, as a means of locating disease, use an instrument called the stethoscope. The development of this instrument is credited to Laennec, a French physician, who died in 1826. Laennec was a specialist in diseases of the lungs, in the diagnosis of which he was very skillful. His instrument was a wooden tube, seven to twelve inches in length and funnel-shaped at either end, the one for application to the ear being smaller than the other. The instrument has been variously modified, the most common forms being double, so that one listens with both ears. There is a form called the *phonendoscope* which magnifies the sounds heard.

Physicians use the stethoscope chiefly to listen to lung sounds and heart sounds; sounds in the arteries, as in aneurism (pulsating tumor); and intestinal sounds, in cases of rupture.

STEUBEN, *stu'ben,* FRIEDRICH WILHELM, Baron von (1730-1794). A valiant and brilliant soldier, Baron von Steuben was a German-American general whose military knowledge and leadership were of tremendous value to the American colonies during the War for Independence. Born at Magdeburg, Steuben entered the Prussian army at the age of fourteen, in 1758 was made a captain and served with distinction in the Seven Years' War. At the close of this conflict, he was elevated to the position of grand marshal to the Prince of Hohenzollern-Hechingen.

Steuben offered his services to the colonies in 1777 and was dispatched to Valley Forge, where he drilled the raw troops in military tactics. He fought at the Battle of Monmouth, aided General Greene in Virginia, and served at the Siege of Yorktown. After the close of the war, he received grants of land from several states and a $2,400 pension from Congress. Steuben spent the remainder of his life in America.

STE'VENSON, ROBERT LOUIS BALFOUR (1850-1894). Pirate gold and adventure,

RULER OF TREASURE ISLAND
Long John Silver, popular Stevenson character.

contained in the pages of *Treasure Island*, have endeared the name of Robert Louis Stevenson to all who have read his famous story. A native of Edinburgh, Scotland, Stevenson studied engineering and then law, but because of poor health he soon turned to writing. He wrote *An Inland Voyage* in 1878 after journeying through France and Belgium by canoe; he completed *Travels with a Donkey* the next year, following a walking tour through the southern part of France. Other stories and essays of his that were published about this time were included in *New Arabian Nights, Virginibus Puerisque*, and *Familiar Studies of Men and Books*.

Stevenson came to America in 1879, crossing the ocean in the steerage. He journeyed to California on an immigrant train and there rejoined Mrs. Fanny Osbourne, with whom he had formed a deep friendship several years before and who was seriously ill. His health, too, suffered by the privations of the trip, but it did not deter him from writing *The Amateur Emigrant* and *Across the Plains*.

The following year he married Mrs. Osbourne and spent some time in an abandoned mining town before returning to Europe. His experiences there were related in *Silverado Squatters*. He went back to Edinburgh, but soon was forced to leave because of his health. He was able, however, to write his best-known stories within the next few years: *Treasure Island, Prince Otto, The Strange Case of Dr. Jekyll and Mr. Hyde, Kidnapped, The Master of Ballantrae,* and two volumes of verse, *A Child's Garden of Verses* and *Underwoods*. In 1890 he settled on the island of Upolu, Samoa, where he spent the rest of his life, writing *David Balfour, Saint Ives,* and *Weir of Hermiston*. The last two were left unfinished, but *Saint Ives* was completed by Quiller-Couch.

BELOVED INVALID AUTHOR
Despite ill health, Stevenson traveled extensively and penned many fascinating books.

Stevenson was greatly loved by the natives of Upolu, who came to consider him their chief. They named him Tusitala, meaning *teller of tales*. When Stevenson died, in 1894, the natives cut a path to the top of Mount Vaea and there buried their beloved chief where he had wished to be. On this tomb is Stevenson's epitaph, written by himself:

Under the wide and starry sky,
Dig the grave and let me lie.
Glad did I live, and gladly die,
And I laid me down with a will.

This be the verse you grave for me:
"Here he lies where he longed to be.
Home is the sailor, home from the sea,
And the hunter home from the hill."

THE SCRAPPY STICKLEBACK
Well armored, he fiercely guards his nest.

STICKLEBACK, *stik''l bak.* Anyone who has an aquarium and wishes to keep fish that will be most amusing should get some sticklebacks. In the northern part of North America they may be caught by drawing a scoop net through water plants in shallow places. The little sticklebacks are only two or three inches long, but are easily distinguished from other small fish by the spines on their backs and plates on their sides.

Sticklebacks are peppery little fish that seem to enjoy a fight with one another or with larger creatures. Most sticklebacks build nests in which to lay eggs. The males build the nests of plant materials and drive the females into them. The males protect the eggs and keep a current of fresh water flowing over them by fanning with their foremost fins. The eggs are protected in this manner for at least two or three weeks.

STILT. Well named are the stilts, long-legged wading birds related to the avocets. One species, the *black-necked* stilt, is found in North America, mostly in the Gulf states and in Western United States north to Oregon and Colorado. It occurs also in Mexico and South America. The bird is about fifteen inches long, and black and white in color. It is often seen walking gracefully about on the shores of marshes, in search of small water animals and similar food among the reeds. It nests on the ground.

STING RAY. With flat, oval bodies terminated by long, whiplike tails armed with spines, sting rays are the bane of the tropical swimmer's existence. There are about fifty species of these fish known, many of which reach a length of from ten to twelve feet. Though the "stinger" is not poisonous, the mucus which it secretes often causes a persistent, painful inflammation.

STOAT, *stote.* See ERMINE.

Gottscho-Schleisner

STOCK. If a group of businessmen decide to build a great factory or to expand one which is already established, they will require large sums of money—more money, perhaps, than they will be able to supply themselves. In order to finance the company, they will permit other people to invest money in the venture; in other words, shares of stock in the company will be sold to raise the necessary capital. Stock represents the total authorized capital of the business, and each investor will receive a stock certificate, indicating the number of shares of stock he holds.

Why do people invest money in an enterprise of this nature? Principally for the income they receive, for so long as a business makes a continued profit, the stockholders usually receive a substantial return on their investment. These divided profits, known as *dividends,* are declared by the board of directors of the corporation, and under normal conditions are paid at regular intervals. No dividends on stock can be declared, however, until current obligations are paid, including interest on any outstanding bonds. In other words, the creditors of the corporation must be paid before the owners, or stockholders, can realize on their investment.

Types of Stock. There are two general kinds of stock, *common* and *preferred.* Common stock has two distinguishing characteristics; it is usually voting stock, and receives dividends only after those of the preferred stock have been paid. Common stockholders are privileged to attend the stockholders' meetings and to vote; the voting strength is directly proportional to the number of shares held. Ordinarily, however, the holder of a small number of common shares allows some larger stockholder to vote his stock by *proxy.* Dividends on common stock are not fixed and may greatly exceed those paid on preferred stock; on the other hand, common stockholders may receive nothing. The amount they receive often depends upon the current profits, though both preferred and common dividends may be paid from *surplus* (previous profits), despite the fact that the company may be currently operating at a loss.

Preferred stock is usually non-voting and receives but a fixed dividend. The fact that preferred dividends must be paid before those of common stock make preferred stock less of a gamble, and a favorite of the more conservative investor. Preferred stock may be *cumulative, non-cumulative, participating,* or *non-participating.* If cumulative, any dividend not paid when due accumulates and must be paid from future earnings; if non-cumulative, the dividend must be paid each year, or is forever lost to the stockholder. Participating preferred stock shares in undistributed earnings with the common stock after the dividend on the common has been paid. Non-participating preferred receives only its fixed return, regardless of how large the profits may be.

Stock is usually issued with a *par value,* a price which would theoretically be paid for the share on a normal market. Usually this value is $100, though $50, $25, and even $10 pars are common. But since the price on the stock market may fluctuate widely, par value is a poor indication of the actual worth of the share. To eliminate this condition, many states now allow corporations to issue *no-par* stock, each share of which represents a certain proportion of the total capitalization. If 10,000 such shares are issued, each individual share is entitled to 1/10,000 of the year's declared dividends. Value of the stock on the market is determined by the company's soundness and earning capacity.

Another type of stock is *treasury* stock, which has been issued by the company in the regular manner, but which has been reacquired, either by donation or by purchase. It may then again be sold in the usual channels. *Bonus* stock is that given by some companies to their employes for faithful work, long-time service, and so on.

Stock Transfers. Stock is readily transferable from one person to another without affecting the unity of the corporation in any way. The purchaser, in order to receive dividends, should have the stock transfer recorded on the books of the corporation; otherwise, the name appearing on the records will receive the dividend, regardless of the present holder of the stock. Stockholders are not liable for the debts of a corporation; in case the company fails, the stockholder loses only what he paid.

STOCK EXCHANGE. Only through the medium of the stock exchange are the big railroad and industrial corporations of the present day possible. Made up of *brokers,* who devote their entire time to the buying and selling of securities, the stock exchange serves as a "middleman" through which corporations with sound securities may reach the investing public. Without this organization, business corporations would meet with considerable trouble and expense in raising operating capital.

The world's first stock exchange originated in London in 1801. Previously, securities had been transferred through brokers who congregated in certain coffee-houses about the city, and there conducted their business. Today, nearly every major city in the world has its own stock exchange. Those in Europe are called *bourses,* and since memberships are limited, seats on the principal exchanges often sell for fabulous prices. In some of the boom years, seats on the New York exchange have sold for prices in excess of $600,000, while during depression years, they have changed hands for much less.

Stock exchanges deal only in *listed* stocks, which means that any company whose securities are bought and sold on the exchange must meet certain financial and legal requirements set up by that organization. *Unlisted* stocks are sold on the *curb* exchanges, where rules governing the financial status of corporations are less stringent. In 1934 American stock exchanges were brought under the control of the Securities and Exchange Commission, whose duty it is to regulate margin requirements, halt price manipulation, supervise members, fix commissions charged, and otherwise to work for the protection of the investor's dollar. See SECURITIES AND EXCHANGE COMMISSION.

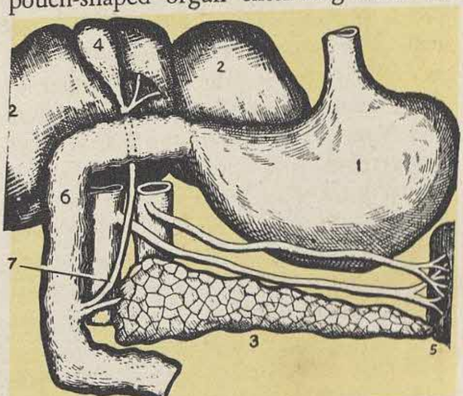
STOCKHOLM, SWEDEN. The capital and largest city of Sweden, Stockholm is situated on Lake Mälar where it flows into the Baltic Sea. Because it is built partly on islands, the city has been called "the Venice of the North."

Stockholm is an old city, founded about 1255, and was originally a fortress. In the old section today the streets are narrow and winding, and some of the quaint, gabled buildings still stand. The newer sections, however, are modern in every respect and have been laid out according to a definite plan, with wide streets, parks, and public buildings.

In Stockholm are the Royal Palace and other government buildings, the Royal Library, the Parliament House, museums, learned societies, and schools. It is in Stockholm, too, that the Nobel Prizes are awarded (see NOBEL PRIZES). Among the interesting old churches is the Church of Saint Nicholas, where the Swedish sovereigns are crowned; it was built in 1264 and is the oldest church in the city. The Franciscan Church has, since the time of Gustavus Adolphus, been the burial place of the sovereigns.

Stockholm is the greatest port in Sweden and is also a transportation center. A leader in manufacturing, its industries include shipbuilding, brewing, silk weaving, and the manufacture of leather, porcelain, tobacco products, iron and steel products, and chemicals. The population is about 804,000.

STOMACH, *stum' ak.* After food is swallowed, it is stored in the stomach, a pouch-shaped organ extending from the



HUMAN DIGESTIVE MECHANISM

(1) Stomach; (2) liver; (3) pancreas; (4) gall bladder; (5) spleen; (6) duodenum; (7) bile duct.

esophagus to the small intestine. When empty it collapses, and when filled, holds about five pints. The end where it joins the esophagus is called the *cardia;* the other, where it unites with the small intestine, is the *pylorus*. It is made up of serous, muscular, cellular, and mucous coats. The muscular coat has three sets of fibers arranged in longitudinal, circular, and oblique fashion, and by their rhythmic action the food is churned, mixed with digestive juices, and then propelled into the small intestine. The mucous membrane, lining the organ, is supplied with glands which secrete the ferment pepsin, together with acids and mucus.

The chief function of the stomach is to aid the other organs of digestion in preparing food for absorption; this it accomplishes by nervous, muscular, and secretory processes. See DIGESTION; GASTRIC JUICE.

STONE. See ROCK.

STONE, HARLAN FISKE (1872-1946). Long an important public figure, Harlan Fiske Stone was the Chief Justice of the United States Supreme Court from 1941 until his death in 1946. Born at Chesterfield, N. H., he was educated at Amherst College and Columbia University, later practicing law in New York City. For thirteen years he served as professor and dean of the Columbia Law School, becoming Attorney-General of the United States in 1924. He was appointed to the Supreme Court by President Coolidge in 1925.

STONE AGE. At the beginning of man's cultural development, hundreds of thousands of years ago, most of his tools and weapons were made of stone. This primitive period, known as the Stone Age, is further divided into the *Paleolithic*, or *Old Stone* Age and the *Neolithic*, or *New Stone* Age. The Old Stone Age probably began about 200,000 years ago and extended to the New Stone Age, which is generally believed to have begun about 25,000 years ago. In the first period, man's crude weapons were fashioned from pieces of flint, which had been chipped from larger rock formations. No agriculture was carried on, hunting was the only means of livelihood, and the dog was probably the only domesticated animal. The Peking man of China and the Piltdown man of England are among the best specimens of the period.

HOW MAN LIVED 200,000 YEARS AGO

(1) A prehistoric huntsman and his crude weapons. (2) Paleolithic wolf, source of both food and clothing. (3) Old Stone Age lanceheads.

In the New Stone Age which followed and probably endured until about 2,500 B. C., man showed remarkable advancement. Though stone still formed the basis of both implements and weapons, most of it was used in a highly polished form. This era saw the development of the bow and arrow, the domestication of many animals, and the true beginning of agriculture. Men left their caves and began to build houses of stone; traces of this civilization may still be seen in Mexico and South America. The use of metal, marking the beginning of the Bronze Age, began about twenty-five centuries before the Christian Era.

STONE'HENGE. England's most important example of prehistoric architecture is Stonehenge, a mysterious group of massive stones on the Salisbury Plain, in Wiltshire, England. No one knows who were the builders of Stonehenge, but archaeologists are of the opinion that it was originally a shrine of the ancient sun worshipers, and was perhaps built in the nineteenth century B. C. It may have been used later as a Druidical temple. Stonehenge was given to the nation in 1915 and is under government supervision. All buildings within a mile of the site have been removed. The enclosure is open to the public, a small fee being charged.

The ruins consist of four concentric semicircular arcs of rough-hewn sandstone pillars. The outer circle, which is about 100 feet in diameter, was originally formed by thirty upright stones, each weighing about twenty-six tons. It now has but sixteen remaining in a vertical position. The second arc, composed of twenty upright bluestones, has but nine standing. Of an unknown number of bluestones in the inner ovoid, only twelve remain. Near the geometric center of this inner arc lies the Altar Stone, approximately sixteen feet in length. An enormous rock, known as the Slaughter Stone, lies to the northeast of the circle. A broad road, flanked by mounds and called the Avenue, leads into the temple from the northeast. See ARCHAEOLOGY.

STONE MOUNTAIN. About sixteen miles to the northeast of Atlanta, Ga., stands picturesque Stone Mountain, a massive, rounded dome of almost flawless granite. This giant rock is nearly a mile long and more than 700 feet high. Into its smooth side is being sculptured a great monument consisting of colossal figures of Confederate soldiers, some mounted, some on foot. The design calls for three groups: mounted figures of Lee, Jackson, and Jefferson Davis; two color bearers and four generals; and an army of infantry on the march. The original sculptor, Gutzon Borglum, was replaced in 1925 by Augustus Lukeman, who prepared new designs for the monument. Work was temporarily halted in 1928 because of a lack of funds, but Julian Harris, an Atlanta sculptor, was later commissioned to complete it. The project required the use of power drills. See BORGLUM, GUTZON.

STONES, PRECIOUS. See PRECIOUS STONES.

STORAGE BATTERY. See ELECTRIC BATTERY.

STORE, RETAIL. The oldest business is retailing, and stores operated for the purpose of selling merchandise are still as important as they were centuries ago, when shops first came into existence. The retail store is the chief link in the exchange of goods between producers and consumers. Retail stores take many forms, and may conduct their business by mail, telephone, or by direct contact with the purchaser.

Types and Organization. Many of the retail outlets in the United States are of the *single-line* type. Such stores stock only one type of merchandise. There are, however, in many small towns, *general* stores which carry a varied stock of merchandise. *Department* stores, which carry many or all lines of merchandise, have developed within the last hundred years, and today are important retail centers, especially in the larger cities. A third type is the *cooperative* store, which is owned and operated by the consumers as a means of securing lower prices.

A modern development in the retail field is the *chain,* consisting of a series of stores spread over a given area and all owned by a single corporation. *Mail-order* stores are also a type of retail outlet, although they have declined considerably since World War I. To offset this decline, mail-order establishments have set up chains of their own.

The retail store is an integral part of the economic life of a country. The huge number of retail stores in the United States do an annual gross business of billions of dollars and employ a considerable portion of the total number of employable people in the country. The annual payroll amounts to billions of dollars.

There are five operations in the conduct of a retail business—buying, management, stocking, shipping and receiving, and selling. In the small neighborhood store, or single-line type, all of these operations may be carried on by one or two persons, but in the large stores there is a division of labor, each operation having a separate staff.

GUARDIANS OF HOLLAND'S DIKES
Awkward and unmusical, storks are often considered good omens and are never molested.

STORK. In many European countries, the stork is considered a symbol of good fortune. Especially is this true in Germany and Holland. Storks are venerated in Holland, for they eat the worms, crawfish, reptiles, and other pests that weaken the earthen dikes. In friendly countries, they often build their nests on the housetops.

Storks are long-legged wading birds belonging to the same order as the herons and ibises. True storks are found only in the Old World. The most common species is the *white* stork, which breeds in various parts of Europe and Central Asia, and in winter migrates to Northern India and Africa. The white plumage is marked with black wing coverts, and the bills, legs, and toes are reddish.

Storks have no song, but make a chattering noise by snapping their beaks. Year after year, the birds return to the same nest, adding to it until it reaches a height of several feet. From three to five white eggs are laid. Because of its tender solicitude for the young storks, the stork is the traditional bringer of babies.

Among the Asiatic storks, the *white-necked* stork, *Japanese* stork, *black* stork, and *adjutant* are the most important.

STORMS. High wind, rain, snow, sleet, or hail, and sometimes thunder and lightning characterize storms, violent disturbances in the atmosphere that frequently cause heavy losses in life and property.

Most storms travel in an easterly direction, but sometimes they move in other directions, and may even remain stationary for a day or more. The winds of cyclonic storms (see CYCLONE) blow spirally in a counter-clockwise direction in the Northern Hemisphere, and clockwise south of the equator.

Cyclonic storms, the most common disturbances, usually cover a large area, and are caused by the flow of air from an area of high pressure to one where the pressure is low. The low-pressure area occurs when the heat of the sun causes the air in a region to ascend. As the air ascends, the pressure is decreased, and air from surrounding cooler regions flows in, assuming a rotary motion. The intensity of the movement increases as the process is continued, and in some cases violent winds develop, as in tropical cyclones, hurricanes, and tornadoes. Occasionally, storms occur in high-pressure areas; these are known as *anticyclonic* storms.

In a local thunderstorm, moisture is created by the cooling of ascending air, condensing into a *cumulus* and then a *nimbus* cloud (see CLOUD). Electricity is generated in a whirling *scud* preceding the nimbus cloud, and it is discharged in the form of lightning.

The center of a storm is the low-pressure area, designated as a *Low* on the weather map; it is quite marked in tornadoes and in tropical cyclones. The center of an *extra-tropical* cyclonic storm, however, is not so definite.

Storms of a general nature are fairly easy to forecast, for there are certain areas on the earth's surface where conditions prevail for their creation. Medicine Hat, Sask., is the origin of many of the storms that cross the central parts of the United States and Canada. The indications of an approaching storm are a falling barometer, cloudiness, and a change in temperature. The United States Weather Bureau maintains numerous stations throughout the nation for the purpose of forecasting the weather, particularly storms, for this knowledge is valuable to farmers, sailors, fishermen, aviators, motorists, and the public in general.

For additional information, consult the following articles:

- Blizzard
- Climate
- Hail
- Hurricane
- Monsoon
- Rain
- Snow
- Tornado
- Typhoon
- Weather Bureau
- Whirlwind
- Wind

STOVE. A necessity in practically every home is the stove. Once, however, it was a luxury, and only wealthy persons could own an elaborately decorated porcelain or iron stove.

The stove has evolved from the fireplace, which has been in existence for thousands of years. In the time of the Egyptians and Greeks, portable heaters made of metal were in use, and rich Romans heated their homes with underground furnaces.

Brick, porcelain, and other materials were used in the manufacture of stoves during the Middle Ages, and some of these, exquisitely constructed and decorated, are still in existence. Iron stoves made their appearance in the fifteenth century and these, too, were elaborately embellished.

Early stoves were used principally for heating purposes, the means for cooking being fireplaces in which eighty to ninety per cent of the heat went up the chimney. Large cooking stoves came into use in the eighteenth century, but the fireplace was not superseded until the removable lid and the use of coal as fuel were established in the nineteenth century. Stoves of this type are still in use in many homes.

Benjamin Franklin invented a stove in the eighteenth century which was quite popular for many years in America. Originally, it was an iron fireplace, made so that it could be moved away from the chimney. Later, it was improved with sliding doors and grates.

In modern city houses and in those of certain rural sections, cooking is done with stoves, while heating is provided by a central furnace. Various metals such as steel, aluminum, and iron are used in modern stoves, and the fuels may be gas, electricity, acetylene, oil, coal, or wood. In some portable stoves, other fuels, such as alcohol preparations and charcoal, are used. See HEATING AND VENTILATION.

HARRIET BEECHER STOWE
Her *Uncle Tom's Cabin* hastened the Civil War.

STOWE, HARRIET ELIZABETH BEECHER (1811-1896). During the years when the slavery issue was becoming increasingly bitter, dividing the North and the South politically, Harriet Beecher grew to womanhood in the family of a Congregational pastor in Litchfield, Conn. Emotional and inclined to social reform, she early became convinced of the injustice of the slavery system. In June, 1851, the first installment of *Uncle Tom's Cabin* appeared in the *National Era*, an anti-slavery publication. The story was published in book form in 1852, and was received enthusiastically in the North. It is impossible to measure the degree to which it was responsible for the Civil War, but probably no other single factor did more to arouse the people of the North against slavery.

Harriet's father, Dr. Lyman Beecher, was called to become the president of Lane Seminary in Cincinnati, Ohio, in 1832, and his daughter went with him and taught school there. She married Professor Calvin Ellis Stowe in 1836, and entered upon years of hard work and struggle to care for her family of five children. Along with her exacting household duties, she managed to write a good many stories which were sold to increase the meager family income.

Professor Stowe received a teaching appointment at Bowdoin College in Brunswick, Me., in 1850, and the family left Cincinnati. For eighteen years, however, Mrs. Stowe had lived across the river from slave territory, had often visited in Southern homes, and had even aided in the escape of slaves by means of the Underground Railroad. This experience, together with her literary ability, prepared her for creating the character of Uncle Tom.

Other works, perhaps of greater literary worth, but less known, are *The Minister's Wooing, The Pearl of Orr's Island,* and *Old Town Folks.* Mrs. Stowe also wrote a number of devotional poems. On a trip which she made to Europe in 1853, many honors were accorded her.

STRADIVARIUS, *strad i va' ri us,* ANTONIUS (1644-1737). For tone, for beauty, and for workmanship, the violins made by Antonius Stradivarius have never been excelled. Born in Cremona, Italy, Stradivarius was a pupil of Nicolai Amati, with whom he worked until 1700, when he opened his own shop. Several hundred of his violins, and a number of violas and violoncellos, are still in existence, all worth large sums of money.

STRAITS SETTLEMENTS. Before being broken up in 1946, this former British Crown Colony, an important part of British Malaya, was composed of the settlements of Singapore, Penang, Malacca, and Labuan. It covered 1,356 square miles, and over half of its some 1,436,000 inhabitants were Chinese. Most of the rest were Malays and Indians.

Seized by the Japanese in 1941-42, the colony was returned to Britain at the end of World War II. Soon afterward Malacca and Penang were made parts of the newly created Malayan Union (see FEDERATION OF MALAYA); Labuan, a part of North Borneo. Singapore and its dependencies, Christmas and Cocos islands, became a separate colony, but in 1951 the Cocos were transferred to Australian administration. See SINGAPORE.

STRAT'IFIED ROCKS. Originally, the layers, or strata, making up most sedimentary rocks were horizontal. But in many areas the wrinkling of the earth's crust caused these strata to fold. The angle of their inclination is called the *angle of dip.* See FAULT; ROCKS; SEDIMENTARY ROCKS.

General Electric Company

SCOUT OF THE STRATOSPHERE

Instrument-carrying rockets provide important information about conditions at high altitudes.

STRATOSPHERE, *strat'o sfeer.* Man's unquenchable ambition to soar to ever higher altitudes has led him inevitably to the stratosphere, the frigid atmospheric layer lying above the troposphere (the air we breathe). It is said to begin at an average altitude of about seven and a half miles. Its extent varies, however. At the equator it begins at a higher altitude than over the poles. The temperature ranges between 100° and 40° below zero (Fahrenheit) at the lower levels, depending on location. The stratosphere contains little water vapor, few clouds, and little vertical air movement. The pressure is much less than in the lower reaches of the atmosphere.

For many years man has increased his probing of the stratosphere to gain scientific knowledge. In 1931 Auguste Piccard in a balloon ascent reached 51,793 feet. Records for manned balloon ascents include the one made in 1960 by Air Force Captain J.W. Kittinger when he ascended and parachuted from 102,800 feet. Unmanned balloons have risen and been recovered from 143,000 feet. Others have disappeared into space. In preliminary testing a rocket-powered X-15 airplane was flown to an altitude of 131,000 feet. Satellites have carried scientific instruments the greatest distance, orbiting the moon and some passing beyond it to be lost in space. See ATMOSPHERE; BALLOON; SATELLITE; TROPOSPHERE.

STRAUSS, JOHANN (1825-1899). The lilting *Beautiful Blue Danube* won this Viennese musician his place as the greatest composer of waltzes. Included, also, in his more than 400 waltzes are *Artist's Life* and *Wine, Women, and Song*. Among his light operas, *Die Fledermaus* is the best known. Strauss began conducting a small restaurant orchestra at the age of nineteen and later made a successful European tour. In 1855 he conducted summer concerts at the Russian capital, and in 1863 became conductor of the Russian court balls.

JOHANN AND RICHARD STRAUSS
The "Waltz King" and master of the tone poem.

STRAUSS, RICHARD (1864-1949). A master of descriptive poems (*Till Eulenspiegel, Don Quixote,* and *Domestic Symphony*) and of opera (*Elektra, Der Rosenkavalier,* and *Salome*), this German composer is a representative of the Wagnerian school of music. He was born in Munich, and at the age of six was already composing music. His *Symphony in D Minor* and several instrumental works were written during his teens. His tone poems often sacrifice a pleasing melody to achieve desired tonal effects.

STRAWBERRY. Of the many small fruits, none is more popular than the strawberry. The plant is a member of the Rose family. The fruit is not actually a berry, for its seeds are contained in tiny pits on its fleshy surface. The heart-shaped, juicy fruits vary considerably in size, but all varieties are noted for their flavor and pleasant aroma. Strawberries grow in almost every temperate country, and a few types thrive as far north as Alaska. The berries are used for preserves, conserves, jams, candies, flavoring extracts, and soda fountain preparations, and as a fresh fruit. They are also preserved by canning and freezing.

Strawberries are comparatively easy to raise, but they do best when planted in rich, well-drained soil with abundant moisture. The plants, which seldom grow more than five inches high, should be set out in raised beds, about three feet wide and separated by paths. An average of twenty-four inches in each direction is considered proper spacing for the plants. In warm regions, they may be set out in the fall; in cooler areas, spring planting is better.

As the plants grow, they send out runners which take root and soon turn the bed into a solid mat of plants, unless the runners are kept back in the row. Cutting these

Courtesy Monsanto Magazine, Monsanto Chemical Company

PRETTY AS A PICTURE

Fine strawberries "sit for a portrait" just after being picked. Some carefully tended patches in warm climates yield as many as eight to ten pickings a year.

runners will result in the production of fewer but larger berries. After two crops, it is advisable to plow up the bed, using the ground for another crop for two or three years. Where there is danger of a deep freeze, the bed should be covered with straw during the winter months.

STRENGTH OF MATERIAL. In building a skyscraper or a bridge, engineers must consider the strength of materials to be used. They must know how much stress may be applied to a structure and what strains might result from this stress. The study of this strength of materials is a branch of the physics of mechanics.

In selecting materials, many factors must be taken into consideration in order that their strength may be determined. For instance, possible imperfections of metals, the methods by which they were manufactured, the aging of concrete, the proportion of "spring growth" to dark rings in wood, and other factors must all be taken into account. How much strength a material has is measured in terms of the various forces a square inch or square centimeter of the material can withstand before breaking apart. The *ultimate strength* is the measurement of that unit of stress applied just before the material breaks.

When the unit of stress is less than the *elastic limit,* the material returns to its original shape when the stress is removed; when greater, the material is stretched, compressed, bent, or twisted into a new shape. The ultimate strength is generally two to four times the elastic limit. The various types of stresses placed on materials are as follows:

Tensile stress is caused by forces which pull directly on a material. In testing, both elastic limit and ultimate strength are measured. Wrought iron and steel have high tensile strengths, while the strength of wood depends on the grain, density, and seasoning. Most wood has a comparatively low tensile strength.

Compressive stress is the force which tends to contract materials, and is sometimes called *crushing* stress. Concrete and cast iron are much stronger in compression than in tension. The shape has nothing to do with the strength of the material.

Shearing stress is the force causing each section of a material to tend to slide over the section next to it. Alloy steels offer the greatest strength against shearing forces.

Bending stress is the force which tends to bend a material. This stress is a combination of tensile and compression stresses.

Torsional stress is a force which tends to twist a material around an axis, such as the forces exerted on the drive shaft of an automobile. The resistance of shafts to stress depends on the forces, within the limits of strength. Hollow shafts are stronger than solid ones having the same cross-sectional area.

Although stresses are seldom measured in construction, the design of a structure is carefully "stress-analyzed" before construction is begun, so that specifications for members of the structure will allow a margin of safety. Sometimes when complicated structures, such as airplane wings, are difficult to analyze correctly, a full-size model is tested to the point of destruction to determine maximum strength.

The ultimate strength and elastic limit of materials are far beyond the limit to which materials will be subjected in actual construction. The actual stress to which the material will be subjected in a structure is called the *working* stress, and is always less than ultimate strength. The ratio of the working stress to ultimate strength is the safety factor. The working stress chosen by the designer is always below the elastic limit; otherwise permanent deformation of members might seriously affect the distribution of stresses, and cause overloading of other members.

STRIKE. When a group of workers in any branch of industry refuses to continue working until certain demands are granted, such action is termed a strike. The strike, a legal means whereby workers may seek these demands, most frequently involves the question of wages, but other important causes are demands for the recognition of a union in the industry, regulation of working hours, protests over the discharge of employes, and the desire to aid other groups. A *direct* strike is called by an organization for its own members; a *sympathetic* strike is called by workers not directly involved, as a means of bringing additional pressure on the employers of the original strikers.

The large majority of strikes are called by union organizations, since these groups have sufficient control over their large memberships to maintain an effective strike. During the course of a strike, it is important that other workers be prevented from taking the strikers' places. For this purpose, *pickets* patrol the entrances to the plant. Violence may result when non-striking workers seek to pass through the picket line or when the employer brings in new workers especially to break the strike. As a rule, the pickets are forced to keep moving, and mass picketing is forbidden. The police enforce these rules so that the strikers cannot form a solid wall around a store or factory, keeping those who wish to enter — whether they be customers or workers — from doing so.

Previous to the passage of the National Labor Relations Act, the settlement of strikes in the United States was on a voluntary basis; but the National Labor Relations Board has the power to investigate strikes, hear grievances, and issue "cease and desist" orders by means of which its decisions can be enforced through the Federal courts. See LABOR LEGISLATION; LOCKOUT.

STRONTIUM, *stron'shi um*. Belonging to the same family as calcium, this metallic element occurs in nature as the carbonate and the sulphate, and in minute quantities in other minerals. Its symbol is *Sr*. Compounds are also found in mineral and sea water and in the ash of some plants. The metal is silver-white, soft, and two and one half times as heavy as water (with which it reacts to liberate hydrogen). It oxidizes quickly when in contact with air, forming oxides.

Strontium salts give a brilliant red color to a flame. Therefore, several are used in fireworks, signal flares, and tracer bullets. Others are used in pigments, ceramics, medicine, and in the manufacture of sugar. Strontium-90, an artificial radioactive isotope, is present in fallout from atomic explosions. It has a half-life of twenty-five years. It is very hazardous, but has several industrial uses.

STRYCHNINE, *strik'nin*. From the seeds of the nux vomica and other plants of the genus *Strychnos,* the powerful, poisonous drug known as strychnine is obtained. It is beneficial in the treatment of certain diseases when administered in very small doses. Prepared in the form of crystals, strychnine has no odor, but does have an extremely bitter taste. A half-grain dose of the drug is frequently fatal to man, while smaller doses produce violent pains and spasms. The drug is also frequently combined with iron and quinine to form a tonic.

STU'ART, STEU'ART, or STEW'ART. The Stuarts, a royal family which ruled both England and Scotland, were descendants of Flaald, the steward of Dol, in Brittany. Flaald's son Alan was a favorite of Henry I and was given lands in England sometime after 1100. His son, Walter, entered the service of King David I of Scotland, who reigned from 1124 to 1153, and became steward of the royal household. The family took its name from this office. James, the fifth of the family to become steward of the royal household, was named one of the regents upon the death of King Alexander III; and his son Walter married Marjory, daughter of Robert I, king of Scotland. It was this marriage which gave the family its claim to the Scottish throne.

Walter's son, Robert, succeeded to the throne as Robert II in 1371 when King David II died without an heir. The first Stuart to occupy the British throne was James VI, son of Mary, Queen of Scots, who in 1603 took the British crown as James I. Subsequent Stuart rulers of England were Charles I, Charles II, James II, Mary II, and Anne. In 1688 James II was driven from the throne, and a long struggle to replace the Stuarts ensued. Mary of Modena, the second wife of the deposed James II, bore James Francis Edward Stuart (1688-1766), commonly called the *Old Pretender*. In 1715 the Jacobites unsuccessfully attempted to place him on the English throne.

His son, Charles Edward Stuart, known as the *Young Pretender* (1720-1788), allied himself with the French and led an army into Great Britain in 1745 in order to secure the crown. He defeated the English with the aid of the loyal Scottish Highlanders, but he found so little support in England that he returned to Scotland. In 1746 he was completely routed by the Duke of Cumberland at Culloden. He later escaped to the continent, where he spent the rest of his life.

STUART, GILBERT (1755-1828). For his portraits of outstanding Americans, including Washington, John Adams, Jefferson, John Jay, Monroe, Madison, and John Jacob Astor, Gilbert Stuart ranks among the best-known American portrait painters. Stuart was born in Narragansett, R. I., and in 1775 went to London to study painting. He remained in England, France, and Ireland until 1792, and painted portraits of

HISTORIC FIGURES OF THE HOUSE OF STUART
Above, Charles I, whose tyrannical reign led to his execution in 1649. Right, "Bonnie Prince Charlie," who vainly strove to regain the throne by force. His army was routed at Culloden, 1746.

George III, the Prince of Wales, and Louis XVI. He returned to America in 1792, and in 1795 he painted the first of his many portraits of George Washington.

STUART, Mary. See Mary Stuart.

STURGEON, *stur′jun.* In the lakes, rivers, and seas of the northern part of North America are found large fish with shovel-like noses, coarse plates for scales, and very queer mouths on the undersides of their heads. These are sturgeon. Though they are among the largest of American fresh-water fish, they feed upon small forms of animal life such as insects and snails, worms and crawfish.

Once a year, sturgeon run up from the sea, or from the lakes in which they live, and lay their eggs in shallow water. At this time many of them are caught and killed, for their eggs are considered an excellent food, and are sold in the market (see Caviar). A sea sturgeon may lay as many as 2,500,000 eggs. Sea sturgeon are found in rivers along the North American coast from North Carolina north, and across the ocean to Europe. Lake sturgeon are the common form in the Mississippi Basin and the Great Lakes. Some sturgeon are also taken in the lakes of British Columbia and Manitoba. Lake sturgeon may reach a length of ten feet, while sea sturgeon are seldom longer than six feet. Except for size, these fish are much alike.

STUYVESANT, *sti've sant,* PETER (1602?-1682). Historians like to dwell upon the fiery characteristics of Peter Stuyvesant, sometimes known as "Old Silverleg" or "Headstrong Peter." Born in Holland, he first served as a Dutch soldier in the West Indies, at the age of forty-two becoming governor of the colony of Curaçao. While battling against the Portuguese in San Martin, he lost a leg; and as a reward was appointed governor of New Netherland.

Arriving at his new post in 1647, Stuyvesant promptly began to rule with an iron hand, making many enemies among his people, but displaying unlimited energy and ability. He was forced, much against his will, to surrender to the English in 1664. He left immediately for Holland, but soon returned to Manhattan Island, spending the rest of his life on his farm or *bouwerij,* from which New York's present *Bowery* derives its name.

STYX, *stiks.* According to Greek mythology, the Styx was the river over which Charon rowed the dead on their journey to the lower world. It was also the name of a small river in ancient Arcadia.

SUBMARINE. This brutal weapon of destruction was first brought into use by the Germans during World War I, and almost paralyzed Allied shipping before the destroyer was built to combat it. Submarines were also active in World War II, but better means of detecting and destroying them lessened their effectiveness.

Early Submarines. As early as 1620 a rowboat covered with leather, built by Cornelius van Drebel, was submerged in the Thames River and propelled by oars. In 1801, in France, Robert Fulton built and operated an undersea boat called the "Nautilus." Such early boats proved impractical, but during the Civil War, the Confederate navy used a number of submarines called "Davids." They were propelled by a screw shaft, worked by manpower. The submarine in its present form was invented by John P. Holland of Paterson, N.J., about 1875. It was 1898, however, before he built one that could be successfully operated. The Germans perfected their very efficient submarine, or U-boat, in the early days of World War I.

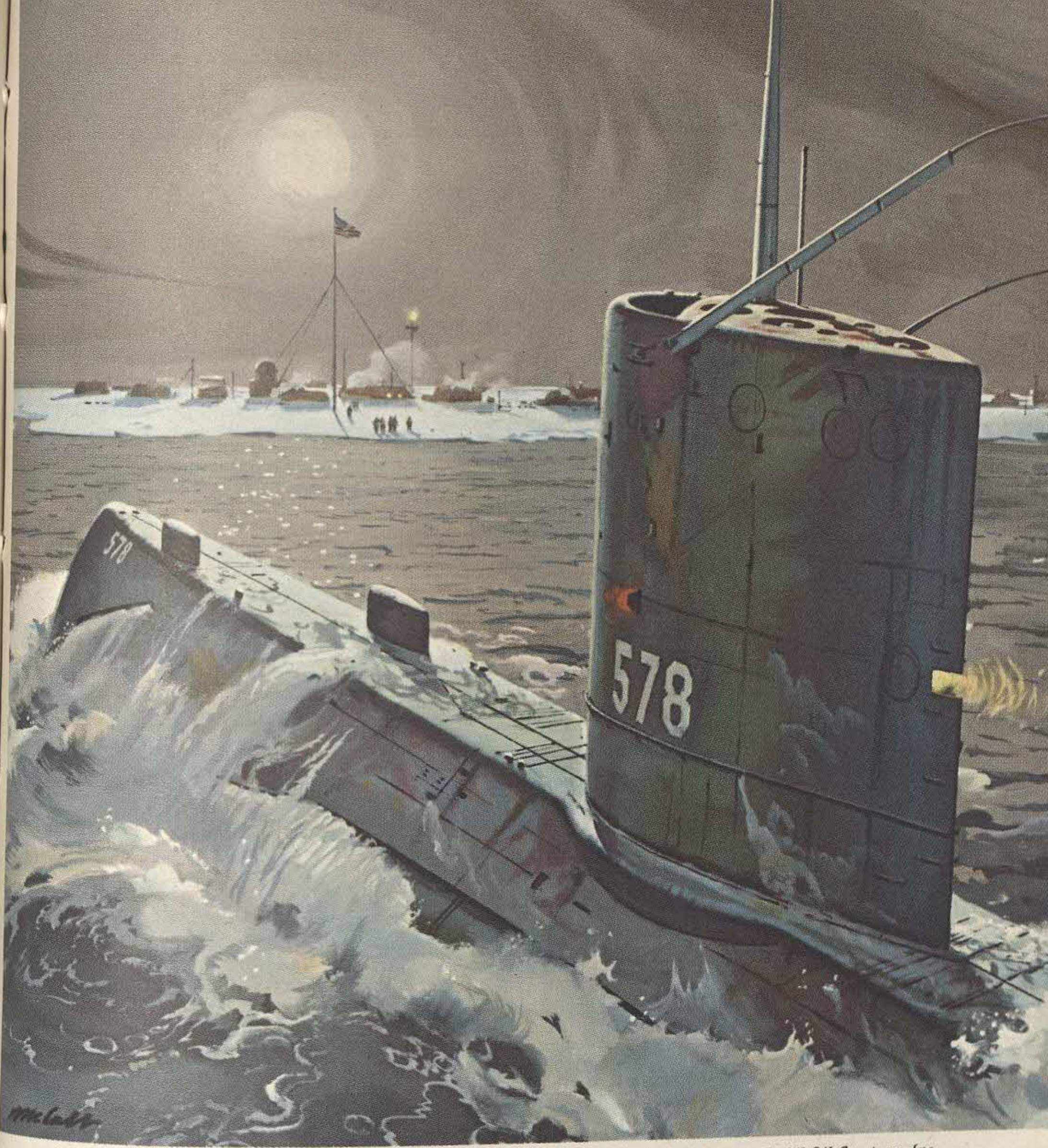
The Modern Submarine. When floating on the surface, a modern submarine resembles a giant whale at rest. There are many uses for these underwater craft. Beside attacking surface craft, they fight enemy submarines, act as scouts, move important supplies, and carry out rescue operations.

Built of steel plates riveted to a sturdy steel frame, these vessels are divided into compartments, some of which are flooded to aid the craft in its descent. A thick fin rising above the deck contains the periscope, or "eyes" of the submarine, and the snorkel. Horizontal rudders, or diving fins, are located near the bow and stern to regulate the diving and surfacing actions. At the stern are the propellers and the steering rudder. Submarines are usually 300 to 400 feet long.

In peacetime, submarines often travel on the surface. In wartime they usually cruise beneath the surface.

How Submarines Operate. Battery-driven electric motors once supplied the submarine's power. In the diesel-powered submarine, cruising just below the water's surface, a snorkel draws in air for the engines and discharges the exhaust under water. At greater depths, electric batteries are used. Nuclear-powered submarines have a small atomic energy plant that does not require air, infrequently needs refueling, and gives greater speed than other fuel sources. These submarines can remain submerged for several months and travel thousands of miles without surfacing. Air in the compartments is purified and re-used by the crew members. Special electronic devices and gyroscopes aid navigation.

Conventional submarines are usually fitted with torpedo tubes and torpedoes for use in time of war. The nuclear-powered submarines, though, are often equipped with nuclear-tipped, long-range missiles that will travel almost 2,000 miles to a selected target. They can be fired while the submarine is submerged.



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ATOMIC SUBMARINE'S NAVIGATIONAL TRIUMPH

The U.S.S. "Skate" made navigational history as it surfaced on target at the weather station Alpha. The submarine had traveled 248 miles under deep Arctic ice without any kind of communications.

Some defenses against submarines have been developed. One device picks up and amplifies the sound of a sub's motor. Depth bombs that explode to crush the sub's hull can then be dropped by a surface vessel. Nets of heavy cables and concentrations of mines are placed at harbor entrances to entangle or blow up the underwater intruder. Aircraft are also used to locate submarines, which appear from the air as narrow, dark shadows in the water. Fliers who sight submarines may direct destroyers and other sea and air craft to the proper location, or may bomb the subs.

SUBMARINE MINE. This device consists of a heavy steel shell, water-tight and filled with an explosive, and a detonator to explode the charge. Such mines are submerged in the water, and when detonated, they explode violently.

Mines are designed to destroy ships, and may be used as a defense, as when a country mines its own waters to keep out the ships of an enemy; or as a weapon of attack, as when a belligerent mines the waters of an enemy nation to blockade its shipping.

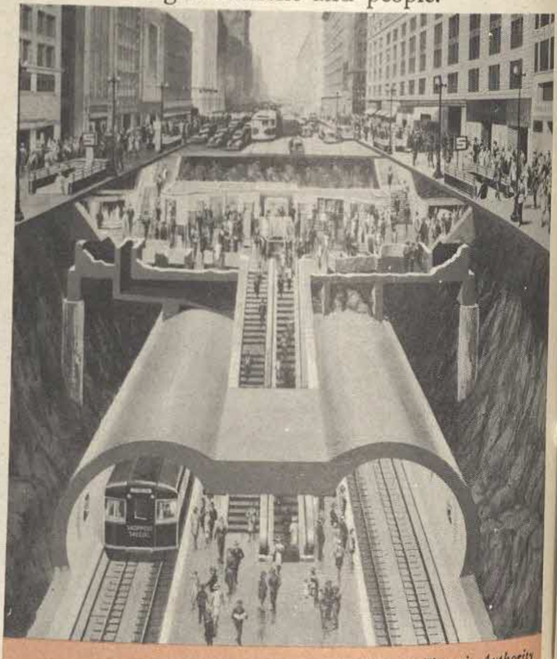
There are two classes of mines: *controlled,* and *uncontrolled.* Controlled mines are those which are set off by remote control, and include those which can also be set to explode on contact with a vessel. Uncontrolled mines are those which will explode when struck, and are dangerous to all shipping when once they are laid. An interesting example of this type is the *magnetic* mine, in which the firing mechanism is put in motion by the magnetic attraction of a ship's steel hull.

Mine Laying and Mine Sweeping. To be effective, mines must be carefully placed. International law requires that all mines must be carefully moored, and so designed that they become harmless if they break adrift. Mines are laid by surface vessels, called *minelayers,* and by submarines; and a certain type may be laid by airplanes.

Mine sweeping (the removing of mines) may be accomplished in a number of ways. One method consists of dragging the bottom with a cable fastened between two ships. Mines may also be exploded in the suspected area, thus destroying any mines "planted" there. Still another method is the use of the *paravane,* a device fastened on the bow of a ship which cuts the mine moorings, causing the mine to rise.

SUB'SIDY. When the United States wanted to start an air-mail service, it was necessary for the government to make contracts with aviation companies for carrying the mail, and to pay them sums which were many times greater than the expected income from the postage. It felt warranted in adopting this policy because of the benefit to its citizens from having this faster method of handling the mail.

From time to time, similar payments have been granted to railroads, street railways, merchant lines, and other types of business which the country was anxious to have developed, but which could not operate profitably without government aid. Towns have often given real estate to corporations to encourage them to construct factories. Nations have also paid farmers and food processors to increase or to curtail food production as deemed desirable, especially during wartime. Such payments, called subsidies, are often used to control market prices, as well as production. If wisely granted, subsidies can be beneficial to both government and people.



Chicago Transit Authority

UNDER THE CITY'S STREETS

This cutaway sketch reveals the subway system.

SUB'WAY, or UNDERGROUND RAILWAY. Many large metropolitan areas of the world have subway systems of underground railways for relieving the congested condition of the streets. Either of two methods of construction may be employed. Entire streets may be closed to

THE STORMING OF BLENHEIM BY THE NORTH BRITISH DRAGOONS
The victory, one of the most important in the Wars of the Spanish Succession, cost France Bavaria.

traffic, excavated to the desired width and depth, walled and roofed over with reinforced concrete and earth, and repaved. This method is used for a four-track system. For one or two tracks a tunnel may be constructed without disturbing the street level. Most of the systems are electrically operated and are designed for the transportation of both freight and passengers.

The first subway for city traffic was completed in London in 1863. The system used steam power. The present London subway is an extensive, well-organized system electrically operated. Paris, Berlin, Moscow, New York, Boston, and Philadelphia all have electrified subways that have lessened their traffic problems; Chicago did not begin to build its passenger subway until 1939, although a freight subway had long been operating in the "Loop" district.

New York's gigantic subway system is the largest in the world. Much of it is double-tracked in each direction to allow for local and express trains. The city-owned system consists of three lines: the Interborough Rapid Transit (I.R.T.), the Brooklyn-Manhattan Transit (B.M.T.), and the Independent Subway (Ind). The Times Square "shuttle" enables passengers to travel from one line to another. A subway has been opened in Toronto, Ont.

SUCCESSION, *suk sesh'un,* **WARS.** Some of the bitterest wars in the parade of history have been fought over conflicting claims to thrones. Three important wars over succession were fought in Europe in the eighteenth century.

War of the Spanish Succession. This war lasted from 1701 to 1714. Charles II of Spain had no successor to his throne, and both Leopold of Austria and Louis XIV of France put in claims before he died. Naturally, the English and the Dutch were greatly concerned, for the union of Spain with either France or Austria would prove a menace to their trade. To overcome these fears, Louis XIV agreed to a partition of Spain with England, but Spanish protests prompted Charles to name the Prince of Bavaria as his successor. The prince died, however, and another treaty was arranged with England whereby France and Austria were to benefit by the partition of Spain.

The Spaniards again objected, along with Austria, and Charles complicated affairs further by naming Philip of Anjou, Louis' grandson, just before he died in 1700. Louis preferred this solution to the partition treaty, and Philip was crowned king, but within a short time England, the Netherlands, and Austria effected an alliance against France.

The war began in Italy, where Prince Eugene of Austria won several skirmishes against the French. In 1702 France, Spain, Portugal, Bavaria, and Savoy found themselves pitted against the alliance. Marlborough, heading the English forces, met with some successes, but the French were victorious in Alsace and Bavaria. Finally, in 1704, Marlborough and Prince Eugene won an important victory at Blenheim, and the French lost Bavaria. Portugal and Savoy went over to the side of Austria and England, and the English followed up their victory at Blenheim by taking Gibraltar.

As the war continued and the alliance won additional victories, Louis several times sued for peace, but it was not until Charles VI became emperor of Austria that the English withdrew from the alliance, and agreed to negotiate a peace. By the Peace of Utrecht, in 1713, hostilities ceased between Holland, France, and England. France, however, continued the war against Austria. Prince Eugene finally was forced to surrender, and Austria accepted the Peace of Rastatt and the Peace of Baden, both in 1714. Queen Anne's War in America was the American phase of this struggle. Philip of Anjou was recognized king of Spain as Philip V. See UTRECHT, PEACE OF.

War of the Polish Succession. Poland's succession war, fought from 1733 to 1735, concerned the right of Stanislaus I Leszczynski to the throne of that country. He had been selected by Charles XII of Sweden and a majority of the Polish electors, and was supported by France, Spain, and Sardinia. Augustus III, elector of Saxony, his rival, was aided by other German states, Austria, and Russia. Stanislaus was unable to withstand a siege in Danzig despite French aid, and was forced to give up the throne in the Treaty of Vienna in 1735. He retained Lorraine, however. Austria and France fought in Northern Italy and the Rhineland. By the Treaty of Vienna, Austria relinquished the two Sicilies to Spain. Augustus III was acknowledged king of Poland.

War of the Austrian Succession. On the death of the Austrian emperor, Charles VI, in 1740, several rulers in Europe refused to abide by the Pragmatic Sanction, which permitted Maria Theresa, Charles's daughter, to assume the throne. Several countries laid claim to the Austrian possessions, which included Bohemia, Hungary, Northern Italy, a part of the Netherlands, and Austria proper. Charles Albert of Bavaria and Philip V of Spain both sought the crown which Charles had wished to leave to his daughter, while England, Holland, and Russia supported the claims of Maria Theresa. France, Spain, Sweden, Bavaria, and Prussia, then ruled by Frederick the Great, were the leading members of the opposing coalition.

Frederick the Great of Prussia opened the struggle by marching into Silesia and seizing that country. The war was divided into various phases, the struggle between Austria and Prussia being termed the Silesian Wars, and that between France and England in America becoming known as King George's War.

Peace was concluded in 1748, after a number of countries had entered and withdrawn from the struggle. In the Treaty of Aix-la-Chapelle, Maria Theresa was recognized as joint ruler of Austria with her husband, Francis I, who had been crowned in 1745, during the war. The treaty, among other details, further reduced Austria's possessions, and Prussia retained Silesia.

For additional information, consult the following articles:

Aix-la-Chapelle
Blenheim
Charles VI
Frederick II
French and Indian Wars
Louis XIV
Maria Theresa
Marlborough, Duke of

THE BONY, RED HORSE SUCKER
A common resident of clear, gravelly streams.

SUCK'ER. Many a boy has stood on a bridge over a river and watched suckers on the gravelly bottom beneath. The boy knows when the fish are suckers because there is a fairly distinct line between the head and body; otherwise the fish have few markings.

In the spring these fish run up into the shallows to lay their eggs, and many are caught by being speared, snared, or "snatched" with a bunch of hooks. They do not bite a hook readily. Suckers caught in clear, cold water are not bad food fish, though they are rather bony. Common suckers may reach a length of twenty-two inches and a weight of five pounds. Millions of pounds of them are netted in the Great Lakes and sold in the market as cheap fish.

Suckers have toothless lips with which they suck up the soft mud from the bottom. From this mud they get their food. The common sucker of the eastern and southern parts of North America is the *white* sucker. In the Far West, the *yellow,* or *Columbia River,* sucker is well known. Among the others are the *flannel-mouthed* and the *hog-nosed* suckers. Several suckers found in the Mississippi Valley are known as *buffalo fish.*

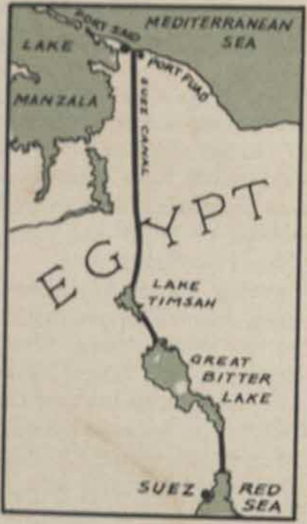
SUDAN, *soo dan',* is a vast region in Africa, extending from southern portions of the Sahara Desert southward through steppes and savannas to the Congo basin. The area is now occupied by the Sudanese Republic, republics of Niger and Chad, and the Republic of the Sudan.

SUDAN, REPUBLIC OF THE, is a country formed of former Anglo-Egyptian Sudan. It is bounded by Egypt, Libya, Chad, Centrafrica, Republic of the Congo, Uganda, Kenya, and Ethiopia. Its port on the Red Sea is Port Sudan. Its capital is centrally-located Khartoum where the Blue Nile joins the White Nile. Its area is 967,500 square miles, and it has about 10,000,000 residents. Sudan was ruled jointly by Great Britain and Egypt between 1899 and 1956, when it became a republic. Part of Sudan in ancient times was the country of Nubia. Long-staple cotton is its great product.

SUDANESE REPUBLIC is a country formed from inner French West Africa. It is bounded by the republics of Niger, Upper Volta, Ivory Coast, Guinea, Senegal, Mauritania, and Algeria. It became independent June 20, 1960, when it formed the Federation of Mali with the republic of Senegal. This federation later broke up. The area of Sudanese Republic is 450,500 square miles, and its population is about 3,708,000. Its capital is Bamako. It had been self-governing since 1958.

SUDAN GRASS. Sudan grass has been the leading forage crop of the dry Southwest for many years. First introduced into America from Khartoum, Egypt, in 1909, it was tested out in Texas by the United States Department of Agriculture. It resists drought well and also thrives with irrigation or plentiful rainfall.

Probably the most outstanding feature of sudan grass is that two, or even three, crops may be cut each year. The plant greatly resembles sorghum and Johnson grass. It has no perennial roots, but grows from



THE MEDITERRANEAN'S GATEWAY TO THE ORIENT

Left, detailed map of the Suez Canal, through which pass thousands of merchant vessels annually. Above, Port Said, on the Mediterranean, has become a great city and coaling station.

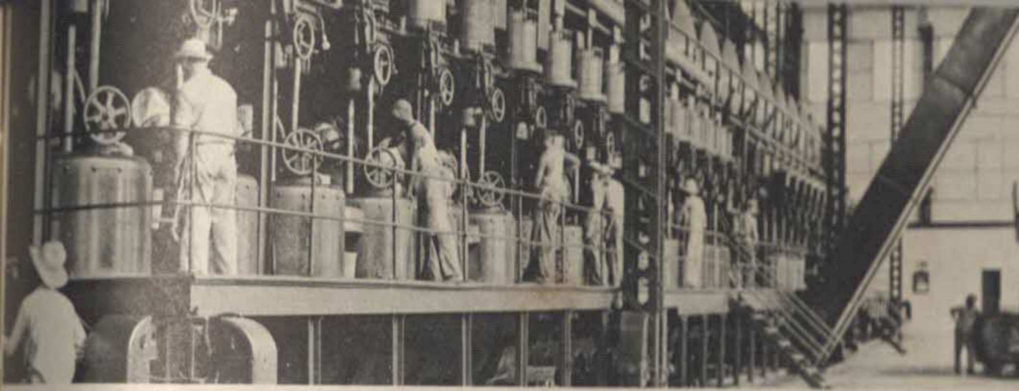
seed each year, thus removing the danger of its becoming a pest. Because it develops rapidly, the first crop maturing in about seventy days, it is sometimes sown where other grasses have been killed by winter frost. Grown both for seeds and forage, the crop is harvested in much the same manner as millet.

SUEZ CANAL. Highly important to world commerce, the Suez Canal extends through the dreary Sinai Peninsula of Northeastern Egypt, from Suez, on the Gulf of Suez, to Port Said, on the Mediterranean Sea. It is a sea-level course, therefore without locks, and is some 103 miles in length. For twenty-one miles its route is through four lakes, so shallow that for only eight miles through them was there found a depth necessary for navigation; therefore, excavation was required for ninety miles. The original depth allowed passage of vessels drawing twenty-four and one-half feet of water; enlargements have been made, and now the maximum depth of the channel is forty-two and one-half feet, the width 196 feet. The original estimated cost was $40,000,000, but the actual total cost has run over $150,000,000.

The canal was the dream of Ferdinand de Lesseps, a great French engineer. He secured a concession from Egypt to build it, and it was completed in 1869. While De Lesseps dreamed of the importance of this waterway, it remained for Disraeli, Lord Beaconsfield, Prime Minister of England, to realize the stupendous value of the canal to the British Empire. When the khedive of Egypt got into financial difficulties because of the excessive cost of the canal, Disraeli contrived to interest English capital in the purchase of canal stock. Thus, Britain came to acquire an influence in Egyptian affairs which proved to be of great political value to her.

Moreover, it became evident to the English that only because of the Suez Canal was it probable that the vast empire of India could be held against possible enemies. Thus the canal not only made the ancient Mediterranean again the highway of a vast foreign commerce, such as had given it fame in ancient days, but it also brought Northeast Africa under British sway and India, then British-controlled, 6,000 miles nearer to England.

But the middle twentieth century which



SWEET LABORATORY

Sugar is processed in a raw sugar mill with scientific precision. Concentrated juices from crystallizer tanks are fed into rows of centrifugal machines, above, for one of the final steps in obtaining raw sugar.

Sugar Information, Inc.

was bringing about the dissolution of the British Empire into independent states, also brought an end to British ownership of the Canal. Great Britain agreed with Egypt in 1954 to evacuate its troops from the Canal zone by 1956. President Gamal Nasser thereupon nationalized the company. Later in 1956, Great Britain and France attempted to occupy the zone on the ground that the Israeli-Egyptian war threatened shipping. The crisis was averted by the action of the United Nations, and Great Britain and France withdrew. The United Arab Republic gained complete control of the Canal.

This natural trade route was used as early as 2000 B.C. In the sixth century B.C., a canal was cut from a lake in the middle of the isthmus to the Gulf of Suez and was used by traders for thirteen centuries. See CANAL.

SUFFRAGE, *suf'fraj.* The right of citizens in a democratic government to vote for officials and for governmental measures is called suffrage. At one time no one could vote unless he could meet rigid requirements as to property holding, religion, and social rank, but such restrictions do not now exist in the United States. Anyone can vote who has reached the age of twenty-one, except that in some states certain educational requirements must be met; for example, there is a reading test imposed in Massachusetts. The Constitution specifically states that "race, creed, color, or previous condition of servitude" shall not disqualify a citizen from the voting privilege. Suffrage was granted to women by the Nineteenth Amendment to the Constitution, effective in 1920. See BALLOT; ELECTION.

SUGAR. Sugar and syrup were first produced in India about the time of Christ, perhaps even earlier—certainly not later than the year A. D. 400. From India sugar cane spread to the East Indies and China, thence to Persia about A. D. 500, and to Spain two centuries later. The Arabians had introduced the plant into Southern Europe and Northern Africa by the ninth century; and for a time, during the Middle Ages, Egypt reached a high point in the refining of sugar.

Little refining took place in Europe before the fifteenth century; about a hundred years later the cane was introduced into the West Indies and South America. In the seventeenth and eighteenth centuries, New England merchants were doing a lively business in sugar smuggled from Cuba, converting it into molasses and rum and then reshipping these products. Only within the last hundred years, however, has the price of sugar been low enough to allow the average family to enjoy this valuable food.

Cane Sugar. The greater part of the world's sugar supply comes from sugar cane. The cane grows only in those portions of the world which are untouched by frost. Cuba, India, Puerto Rico, Australia, Brazil, the Hawaiian Islands, and the United States are important producers. The hotter the climate, the higher is the sugar content.

HOW SUGAR IS MADE FROM SUGAR BEETS

The big beets, such as this one, left, are shipped from the fields and [illegible] "wet" hopper, center. Streams of warm water remove dirt and carry beets to the factory. Finally, beets are shredded and soaked in hot water, right, to obtain the sugar.

Sugar Information, Inc. [illegible]

After the cane has been gathered, it is washed and shredded or cut into short pieces. It is then run through a set of three rollers to extract the juice. The juice is treated with chemicals to bleach and purify it. After being filtered, it is heated in evaporators and reduced to a syrup. The syrup is boiled until it crystallizes, forming massecuite, pure sugar with a small percentage of syrup. The massecuite then passes to a mixer, where it is stirred by mechanical paddles to prevent caking.

It next passes into centrifugals (revolving cylinders), where it is whirled violently and washed. The liquid from the centrifugals is boiled several times and becomes commercial molasses. The sugar in the centrifugals is carried to granulators on conveyors and is completely dried, bagged, and marketed as granulated sugar. Coffee sugar and brown sugar, two cheaper grades, are made from the remaining syrup. Loaf sugar is made by molding granulated sugar.

Beet Sugar. The other important source of sugar is the sugar beet. Germany, France, and Russia are important producers, as are Colorado, California, Montana, Idaho, and Michigan in the United States. The sugar beets are first chopped or sliced and then placed in iron cells where water is constantly circulated among the chips. The juice passes into carbonation tanks, where it is treated with [illegible] lime solution and carbonic acid gas. The gas and lime combine, dragging the impurities to the bottom of the tank. After filtering, the solution is evaporated and treated like cane sugar.

Maple Sugar. The chief source of maple syrup and sugar is the hard, or sugar maple. The black, silver, and red maples are other sources. In early spring, a hole about two inches deep is bored in the tree trunk, and

SUGAR STARTS WITH HARD WORK

A sugar cane harvester (opposite page) slashes the cane close to the ground with a knife and [illegible]

[illegible]

a small metal or wooden spout is driven into the opening. The sap drips from the spout into a bucket attached below. It is collected, placed in a tank, and slowly evaporated to a rich, brown syrup. Further evaporation produces maple sugar. Vermont, New York, and Ohio are the heaviest maple-sugar producers in the United States; Quebec, Canada, is one of the world's leaders in production.

Sugar Refining. Much of the sugar consumed in the United States is imported in the form of raw sugar. This is dissolved in lime water, evaporated, and filtered through charcoal to remove the color. It is then processed in the same way as domestic sugar. San Francisco, New York City, Philadelphia, and New Orleans are the most important refining centers.

Production and Consumption. The annual world production of sugar is about 54,000,000 tons. About 9,000,000 tons are consumed in the United States, where the per capita consumption is almost 100 pounds. Sugar ranks high as an energy food. See MAPLE; SUGAR BEET; SUGAR CANE.

SUGAR BEET. Sugar was first obtained from the sugar beet by Andreas Marggraf, a German chemist, in 1747, but there was little production until the nineteenth century. About one third of the world's sugar now comes from sugar beets.

The sugar beet is a member of the Goosefoot family and is related to the common garden beet. The sugar beet is a biennial, developing a large, fleshy root the first year and producing seed the second. The beets contain from 15 to 18 per cent sugar. The tops and small beets are fed to livestock. See SUGAR.

SUGAR CANE. Although the sugar beet outranks the sugar cane in domestic production in the United States, two thirds of the world's supply of sugar is derived from cane. Sugar cane is a tropical and semi-tropical plant, for it will not grow in regions penetrated by frost. The chief sugar-cane regions of the world are Cuba, India, Java, Hawaii, Puerto Rico, Brazil, Louisiana, the Philippines, and Australia.

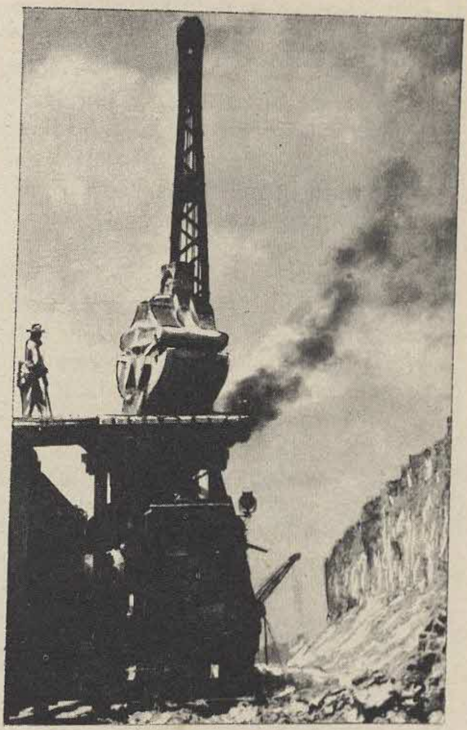
One of the most important grasses, sugar cane has jointed stalks from one to two inches in diameter and grows to a height of from five to eighteen feet. It is not unlike corn in appearance. The leaves of the plant, like those of corn, are wide and pointed, usually growing to a length of three feet. When young, sugar cane is green; but as the plant matures, the upper leaves turn to a purplish color, the lower ones withering and dropping from the stalk. In the tropics, the plant produces a large, conical blossom, but farther north no blossoms appear.

To raise a good crop of cane, the soil must be rich and capable of holding moisture. In the West Indies, the crop is sometimes planted simply by making a hole in the ground and inserting a joint of cane. In Louisiana, however, the lengths of cane are laid in shallow trenches and are covered with fertilizer and soil as protection against frost. As the crops are perennial, a single planting will last as long as ten years; but usually the crop is plowed up and replanted every two years. About eight months are required for maturity.

Harvesting is done by cutting the cane with a big knife about two inches above the ground. The leaves are stripped off and the top severed, only the stalks being carried to the mill. Good cane will produce about 3,500 pounds of sugar per acre. In sugar-cane regions, people often chew pieces of cane for its sweet juice. See SUGAR.

SULFONAMIDE DRUGS. The "sulfa drugs," a group of synthetic compounds derived from coal tar, can destroy bacteria without harming the patient. They have a toxic effect, however, and should be used only under a doctor's direction.

Sulfanilamide, the first of these compounds to be used in medicine, was discovered in 1908, but until 1933, when its value as a drug was discovered, was employed in making dyes. Among the other compounds in this group are sulfapyridine, sulfadiazine, and sulfathiazole. The sulfa drugs have proved very useful in treating



KING-SIZED BITES OF SULFUR
Giant clamshells make short work of loading the golden mineral in a Texas open pit mine.
Santa Fe R.R.

certain infections of the urinary tract, meningitis, and bacillary dysentery. They are often administered in combination with penicillin. They are useful also in preventing infection of open wounds.

SULFATES. The chemical salts formed by combining sulfuric acid with various elements are called sulfates. They are of great commercial importance, particularly in the manufacture of inks, dyes, varnishes, and medicines. The sulfates, except those of barium, strontium, calcium, and lead, are soluble in water. Among the most valuable sulfates are *calcium sulfate,* known in certain forms as gypsum, alabaster, selenite, and plaster of Paris; *copper sulfate* or blue vitriol, extensively used in dyes, insecticides, pigments, batteries and in purifying water; and *ammonium sulfate,* a fertilizer.

Aluminum potassium sulfate is commonly called alum; and sulfate of *iron* (copperas or green vitriol) is used in dyeing, inks, as a deodorizer, and in water purification. *Quinine sulfate* is a valuable medicinal product, and sulfate of *zinc,* or white vitriol, is used in medicines, calico printing, bleaching, and in preservatives. See Sulfuric Acid.

SULFUR. A common mineral widely distributed throughout the world both in a pure form and in combination with various metals, sulfur is a light yellow, nonmetallic element which holds an important place in many industries. It is essential to the health of the human body and is present in eggs and a number of vegetables. Odorless and tasteless, sulfur melts at 113° to 119° C. and is insoluble in water. Pure sulfur is usually associated with gypsum or clay in volcanic or sedimentary rock formations. Large beds of pure sulfur have been found in Sicily, Texas, and Louisiana. Other commercial deposits are located in Mexico, Japan, Argentina, Colombia, and Peru. The United States mines about half of the world's supply of sulfur. Pyrites also form an important source of sulfur, and large quantities of these ores are mined in several countries of Europe, and in Tennessee, Virginia, and California.

When sulfur occurs in a pure form near the surface, it is quarried and melted to separate it from clay, gypsum, and other impurities. When it occurs far beneath the surface, as in Louisiana and Texas, it is mined by the Frasch process. A hole is drilled down to the bed and four pipes are sunk, one inside the other. Compressed air is sent down the inner pipe to force to the surface through the two outer pipes the sulfur which has been melted by superheated hot water passed into the second pipe. On a large man-made steel island about seven miles out in the Gulf off the coast of Louisiana, this process is used to bring sulfur from many feet below the surface.

As the mineral is brought up, it is spread out in great masses to cool and harden, after which it is broken up and shipped. Sulfur is sold commercially as flowers of sulfur, a fine yellowish powder condensed from sulfur vapors, and as stick sulfur, which is made by casting molten sulfur in molds.

The most important use of sulfur is in the manufacture of sulfuric acid (see SULFURIC ACID). Gunpowder, explosives, fireworks, and matches require great quantities of sulfur in their manufacture, and sulfur also plays an important part in vulcanizing rubber (see RUBBER AND RUBBER MANUFACTURE), and in the compounding of some medicines. The sulfur compounds are very important commercially. They include sulfur dioxide, which is used as a bleach for some fabrics, a food preservative, a disinfectant, a refrigerant, and in the manufacture of paper. Carbon disulfide is used in the manufacture of rayon, rubber, waxes, insecticides, and other chemical products. The symbol for sulfur is S. See SULFATES.

SULFURIC, *sul fu'rik,* **ACID.** As chemistry has come to play a role of ever-increasing importance in industry, sulfuric acid has become extremely important. Great quantities are processed to supply the needs of manufacturers. Sulfuric acid, a powerful compound of sulfur, hydrogen, and oxygen, is a dense, oily, colorless liquid which rapidly decomposes both animal and vegetable tissue. The acid has two important properties in that it is a good oxidizing agent and also a good dehydrating (water-removing) agent. It reacts with almost all metals and a great many nonmetals to form salts of the acid (see SULFATES). It also mixes in all proportions with water.

The acid is prepared in two ways, by the lead-chamber and the contact processes. In the first, sulfur or pyrite (iron sulfide) is burned to produce sulfur dioxide, which is driven into a tower known as the *Glover* tower. Here the sulfur dioxide reacts with nitrogen oxide to form sulfur trioxide. The sulfur trioxide passes through lead-lined chambers, where steam is introduced to form a sulfuric acid that is about 65 per cent pure.

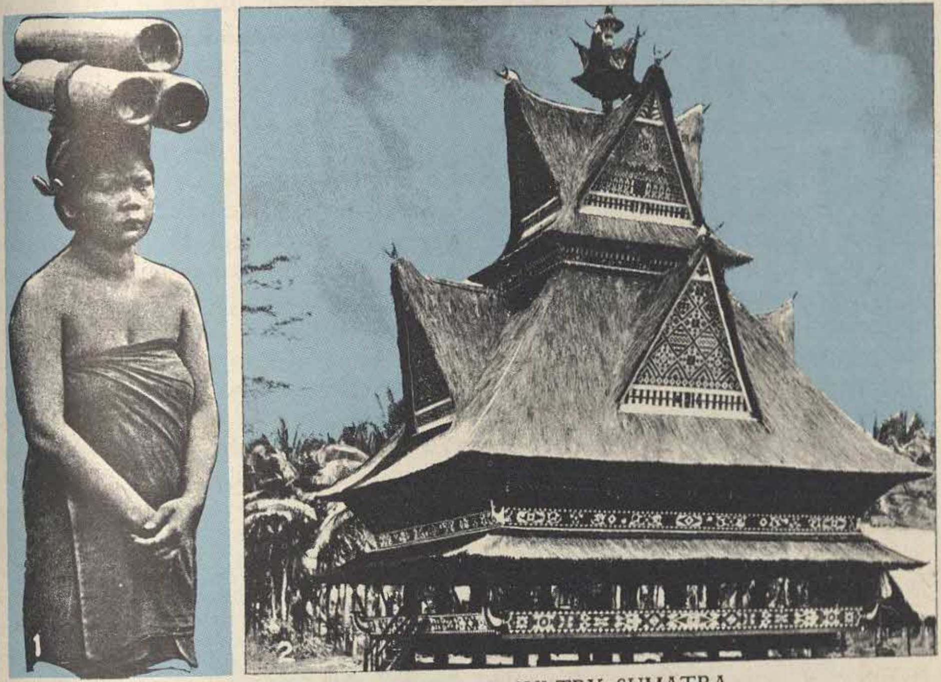
In the contact process, sulfur is also burned to form sulfur dioxide, is purified, and then put through a process of oxidation in the presence of a catalyst such as platinum, reducing it to sulfur trioxide. This is then dissolved in concentrated sulfuric acid to form fuming sulfuric acid, to which water is added. This process forms a very pure sulfuric acid.

Sulfuric acid is used in the manufacture of high explosives, fertilizers, petroleum, dyes, drugs, metals, storage batteries, ether, iodine, parchment papers, celluloid, starch, and many other commercial products. It is also utilized in calico printing, tanning, and in the separation of nitric and hydrochloric acids from their salts. See SULFUR.

SUL'LIVAN, ARTHUR SEYMOUR, SIR (1842-1900). Bright, musical satires such as *The Mikado, H. M. S. Pinafore, Iolanthe,* and *Pirates of Penzance,* which were written in collaboration with W. S. Gilbert, have won Arthur S. Sullivan, English musician, world-wide renown as a composer of operettas. Born in London, Sullivan studied music with his father, at the Royal Academy of Music, and at Leipzig, and in 1862 he attracted considerable attention with his music to Shakespeare's *Tempest.* He also wrote many oratorios, songs, and anthems. His musical setting for *The Lost Chord* is widely popular, and his hymn tune *Onward, Christian Soldiers* continues to be sung in many churches. Sullivan was knighted in 1883. See GILBERT, WILLIAM SCHWENCK.

SU'LU ISLANDS. The southernmost group in the Philippine Islands is the Sulu Archipelago, comprising Sulu Province. In all, there are hundreds of small islands in the group, with a combined area of about 1,100 square miles. The capital is Jolo, on the island of that name. The most important groups in the archipelago, which extends southwestward from Mindanao, are Samales, Tawitawi, Tapul, Pangutaran, and Jolo. Teak and sandalwood are found in the forests; rice, coconuts, bananas, oranges, mangoes, and breadfruit are grown; and pearls and pearl shell are major products. The Moslem inhabitants, are known as Moros.

SUMAC, *shoo'mak,* **or SUMACH.** Widely scattered throughout both the tem-



LIFE IN LITTLE-KNOWN, SULTRY SUMATRA

(1) A lower-caste Battak woman gracefully transporting bamboo water vessels. (2) Unique religious temple. Note the carved wooden heads of buffaloes adorning the gables.

perate and tropical regions of the world are the numerous species of sumac, members of the cashew family. In this interesting group of trees and shrubs are several poisonous plants, notably the *poison* sumac and the highly irritating *poison ivy*. The common *smooth* sumac and the *mountain* sumac, with scarlet autumn foliage and fruit, are found throughout Eastern United States. The former is much used as an ornamental shrub, the latter as a source of a yellow dye and a tanning extract. Probably the best-known North American species is the *staghorn* sumac, characterized by a peculiar zigzag growth of its branches, the flaming-red color of its autumn leaves, and the spikes of small dark-red berries at the top. This red fruit was much used by early settlers as a source of dye.

The largest of the sumacs is the poison sumac, found in the swamps of Eastern United States. It often grows to a height of thirty feet and its trunk attains a diameter of ten inches. In the fall its leaves turn bright red and orange and attract the unwary. Both flowers and fruit resemble those of the poison ivy. A poisonous *Japanese* sumac produces a valuable sap, from which a high-grade lacquer is made.

SUMATRA, *soo mah'tra.* One of the Great Sunda Islands, now a part of the Republic of Indonesia, is Sumatra. It has an area of about 167,000 square miles. The island is a part of the Malay Archipelago, and is separated from the Malay Peninsula by the Strait of Malacca and from Java by Sunda Strait. A chain of mountains, with numerous volcanic peaks and several active volcanoes, extends throughout the length of the island. The peaks are from 5,000 to more than 12,000 feet above sea level, and the mountains are covered with dense forests.

The eastern portion of the island consists of a great alluvial plain, crossed by several navigable rivers which carry most of the trade of the island. The principal rivers are the Rokan, the Musi, the Jambi, and the Indragiri. The island abounds in lakes, the largest being Lake Toba. Crossed by the equator, Sumatra has a true tropical climate, with great heat and heavy rainfall; precipitation is as much as 122 inches in the western section.

Sumatra has rich deposits of mineral wealth. These include coal, gold, silver, lead, and sulphur. There are also some oil fields which are now being extensively exploited. Agriculture, however, is the principal occupation, and rubber, vegetable oils, rice, pepper, coffee, tobacco, cotton, and kapok are leading products. There has been major development of rubber, palm oil, and tea. Farm products are the leading items of export of the island. Among the species of natural vegetation are mangroves, myrtles, palms, oaks, camphor trees, and the gigantic rafflesia, with blossoms as much as twenty-four inches in width. The forest products include gums and resins, camphor, quinine, benzoin, catechu, gutta-percha, caoutchouc, and ebony. Among the animals of Sumatra are the elephant, rhinoceros, Malayan bear, tiger, tapir, deer, and several kinds of tropical birds and snakes.

North, South, and Central Sumatra make up three provinces of the Republic of Indonesia, which took over sovereignty from the Dutch in 1949. Most of the 14,000,000 inhabitants of the island are Malays. Sumatra has almost 16,000 miles of highways and about 1,200 miles of railroads.

SUM'MER. With its long, lazy, warm days, summer is the season of vacations and is the time when vegetation is most colorful. Gorgeously hued blossoms of garden and field blend with the green and gold of ripening grain. Clear blue skies are common, beckoning all to enjoy the out of doors.

The word *summer* is derived from the Anglo-Saxon *sumor,* meaning *hot season.* In the Northern Hemisphere, it officially begins on the longest day of the year, June 21, or thereabouts, and ends three months later, when day and night again become equal in length. See SEASONS; SOLSTICE.

SUMP'TUARY LAWS. In ancient Greece and Rome, laws were passed limiting the amount that citizens might spend for food and clothing. The purpose of such legislation was to prevent extravagance. Similar laws (called *sumptuary,* from the Latin for *to spend* or *use*) have been enacted in medieval and modern times. During the World Wars, the belligerent nations had stringent regulations concerning private consumption of food, gasoline, coal, and other products. Laws restricting the use of commodities on moral or religious grounds are also regarded as sumptuary legislation. An example of such legislation is a law forbidding the sale of intoxicating liquor.

Courtesy Mount Wilson Observatory

OLD SOL'S FLAMING GASES

The sun's corona, stretching out nearly ten million miles, is plainly visible here.

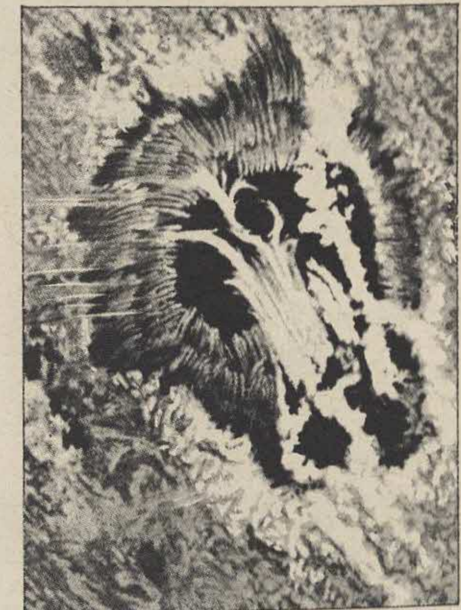
SUN. Early man, mystified but thankful for the light and warmth of day, worshiped the sun as a god. Modern man can understand this adoration, for to dwellers on our planet, the sun is the source of light, heat, and life. Civilized man no longer regards the sun as a deity, for he has learned that it is the center of the solar system, that it is a star just like those we see at night, and that, if placed as far away as the North Star, it could hardly be seen, if at all.

Even though the sun is but a small object in the universe, its volume is tremendous in comparison with that of the earth — in fact, about 1,300,000 times as great. It has a diameter of 865,000 miles; but, because it is composed entirely of gases, its mass is only 333,000 times that of the earth. The very fact that it is more than 93,000,000 miles away is proof of the tremendous amount of heat constantly generated by the sun.

Like the planets it governs, the sun turns on its axis. The period of rotation at the sun's equator is about twenty-five days, but this center mass rotates faster than the areas at a distance from the equator. Although this fact is supposed to prove that the sun is a gaseous mass, the phenomenon is still a subject of controversy among astronomers.

Scientists have made exhaustive studies of the sun, but so far they have been able to learn only the nature of the surface, or *photosphere,* which is a brilliant white in color. Surrounding the photosphere is an envelope of flaming hydrogen, helium, and calcium, called the *chromosphere;* when viewed through the spectroscope, it is red in color. Other features discerned are irregular prominences, regions of the chromosphere which extend hundreds of thousands of miles beyond the surface; and another envelope called the *corona,* which, during a total eclipse, has the appearance of a halo or crown.

Also of great interest to scientists is the fact that the sun's surface (photosphere) is not uniform in color but has patches of darker areas known as sunspots. These spots are irregular in shape, ranging from 150 to 150,000 miles in diameter; and they progress with time from high latitudes toward lower ones. Strangest aspect of the sunspots, however, is that the total number recurs more or less regularly at intervals of about eleven years; there is much speculation regarding their effect on the earth.



TELESCOPIC VIEW OF A SUNSPOT
Of enormous size, these roving phenomena of the sun seldom last more than one day.

What goes on in the great space between the earth and the sun remains much of a mystery. For many years scientists have known there are minute particles of matter — cosmic dust, cosmic rays, comets, solar radio waves, magnetic fields, and several electromagnetic waves which include light. But the causes of auroras and sudden disturbances in the earth's ionosphere, interference with short wave communications, and increased bombardment with cosmic rays, continue to be studied. Earthbound instruments have proved inadequate to span the great area reaching to the sun. However, modern rockets and satellites are constantly increasing man's information about the sun. Since the heat radiating from the sun's core has a temperature of about twenty-seven million degrees Fahrenheit, special materials are necessary for a satellite to come close to the sun and survive long enough to relay any information that is collected back to the earth. At a comparatively close range of two million miles from

Yerkes Observatory, courtesy U.S. Steel

LIKE A CELESTIAL HYDROGEN BOMB

The sun has been "on fire" for more than 500 million years. By ordinary burning it would have consumed itself in about 2,000 years. Scientists now believe that the sun generates its tremendous energy by a process known as the hydrogen chain, which may be thought of as a slow, controlled hydrogen bomb—the process known as nuclear fusion.

the sun's surface, the temperature is about 5,000 degrees Fahrenheit, or about the melting point of some of the toughest materials known today. See also ASTRONOMY; ECLIPSE; ECLIPTIC; SOLAR SYSTEM; SPECTROSCOPE; STARS.

SUNDA ISLANDS. These are two large groups of islands lying south of the Malay peninsula. They include the islands of Sumatra, Java, Celebes, Flores, Timor, Sumba, Sumbawa, Lombok, Bali, and Borneo, belonging to Indonesia. They export agricultural products.

SUNDAY. See SABBATH.

SUNDAY SCHOOLS, or BIBLE SCHOOLS. When poor children worked in the factories of England, they were unable to receive an education. In 1780 Robert Raikes began holding Sunday classes for reading, writing, and religious instruction. As general education gradually became compulsory, the Sunday school began to stress only religious education. In the United States the American Sunday School Union was formed, and by 1872 was co-operating with British groups toward uniformity of teaching in Protestant Sunday schools. In 1907 the movement became the International Sunday School Association. Today materials and methods have made much progress and many teachers receive special training. Usually separate schools are conducted for the primary, junior, intermediate, and adult groups instead of all meeting together.

SUN DIAL. See CLOCK.

SUNFISH. Its rounded, somewhat orange-colored body gives the sunfish its name. Related to the bass, it is six to eight inches long and rarely weighs more than half a pound. Sunfish are excellent as a sporting and a food fish.

SUNFLOWER. Named because of its resemblance to the sun and because it turns its face constantly to the sun, the sunflower is a member of the large Composite family. The plant grows three to fifteen feet tall and the flowers measure a foot or more across. The seeds are valuable as a source of oil and as a feed for birds.

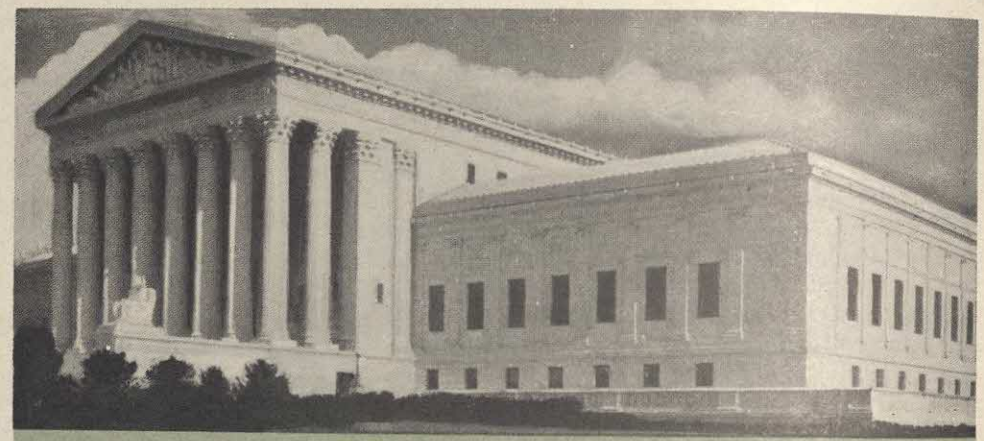
SUPERIOR, *soo peer' ih er,* LAKE. In addition to being the largest of the five Great Lakes, Lake Superior is also the largest fresh-water lake in the world. The westernmost of the Great Lakes, it is 600 feet above sea level, and has the highest elevation and greatest depth of any of the Great Lakes. The lake touches the states of Minnesota, Wisconsin, and Michigan, and the Canadian province of Ontario. Its length is about 400 miles and its width, about 160 miles; its area is almost 32,000 square miles.

Including its own water surface, Lake Superior has a drainage basin of over 80,000 square miles from about 200 rivers and streams. The shores are rocky and steep, particularly on the north where some cliffs rise to 1,000 feet. The lake abounds with trout, whitefish, and sturgeon.

Lake Superior empties into Lake Huron through the Saint Marys River. The Sault Sainte Marie canal system aids navigation through the river. The leading cities on Lake Superior are Duluth, Superior, Fort William, Marquette, Ashland, Sault Sainte Marie, and Port Arthur. See GREAT LAKES, THE; SAULT SAINTE MARIE.

SUPPLY AND DEMAND. Supply, in its economic sense, does not mean the amount of goods produced, but rather the quantity of any article offered at a given price. We often say that the supply varies with the price, and that it will decrease as the price decreases, and increase as price increases. Demand, by the same reasoning, is the quantity of an article demanded at a given price. Thus demand also varies with the price and will increase as the price decreases and decrease as the price increases. Price, therefore, influences both supply and demand. Other factors, however, must be considered, such as cost of production, monopolies, and the natural and artificial forces underlying supply and demand.

The result is that the law of supply and demand, in modern economic theories, is used as a basic principle, but close attention is paid to the other factors that also are an influence on the supply and demand situation. See ECONOMICS.



SEAT OF THE NATION'S HIGHEST TRIBUNAL
Symbolic of the integrity of the United States Supreme Court is this fine edifice.

SUPREME COURT OF THE UNITED STATES. Sometimes called the most exalted judicial body in the world, the Supreme Court of the United States is one of the three branches of government provided in the Constitution. Its duties are to interpret the Constitution, to see that it is upheld in legislation and in courts of law, and to serve as the highest judicial body in the United States.

The Constitution simply provides for the Supreme Court and briefly outlines its duties. All other details are left to Congress. To expedite the work of the Court, Congress established a number of inferior courts, known as district courts and circuit courts of appeal. The Supreme Court is composed of a Chief Justice (salary $35,500) eight Associate Justices (salary $35,000). When originally organized, however, there were six members; the number has been changed several times since then. Justices are appointed for life, and any member reaching the age of seventy may retire at full pay, provided he has served ten years.

The Supreme Court is not officially a court of review; it is a court of justice and interpretation. Laws passed by Congress are not tested for constitutionality until a test case comes before the Court. Hence, if no one contests a law, it remains in force regardless of its constitutionality.

Under Chief Justice John Marshall the powers of the Supreme Court and the scope of the Constitution were considerably broadened by interpretation. Ever since, the Court has not remained rigid in opinions but has varied its interpretations to suit the times and circumstances. It has, however, served as a stabilizing influence in American government, for the Justices are supposed to be outstanding constitutional authorities.

Powers of the Court. The jurisdiction of the Supreme Court as outlined in the Constitution includes:

(1) All cases affecting ambassadors, other public ministers, and consuls.

(2) All cases of admiralty and maritime jurisdiction.

(3) Controversies to which the United States shall be a party.

(4) Controversies between two or more states.

(5) Controversies between citizens of different states or between the citizens of the same state claiming lands under grants of different states.

(6) Controversies between a state or the citizens thereof and foreign states.

When other cases are tried in the Federal courts, they must begin in a district court; from there a case may go to the court of appeals; only a few finally reach the Supreme Court.

There have been fourteen Chief Justices: John Jay, John Rutledge, Oliver Ellsworth, John Marshall, Roger B. Taney, Salmon P. Chase, Morrison R. Waite, Melville W. Fuller, Edward D. White, William Howard Taft, Charles Evans Hughes, Harlan Fiske Stone, Frederick Moore Vinson, and Earl Warren. See Constitution of the United States.

SUR′GERY. A branch of medical science devoted to the curing of disease and the healing of injuries by means of operations, modern surgery has developed only during the last century. This development has been due largely to three important discoveries: anesthesia for the relief of pain; antisepsis for the prevention of infection; and X-rays for locating disease-causing growths and injuries within the body. Anesthesia was developed through the work of such men as Crawford W. Long, William Morton, and James Y. Simpson. Antisepsis resulted from the work of Joseph Lister, who applied to surgery Pasteur's discoveries about bacteria. X-rays were discovered by Roentgen in 1895.

Surgery has many purposes, such as: to repair parts of the body injured in accidents; to repair organs which have been affected by disease; to cure or arrest disease by removing the factors which cause them; to prevent suffering in the case of incurable disease; to correct deformities; and to diagnose the causes of disease.

Modern surgery has advanced so far that it is now possible for surgeons to perform successful operations on the most delicate organs of the body. Brain operations are frequently and successfully performed. Operations on such a vital organ as the heart are no longer uncommon. In the removal of diseased or injured organs and replacement with healthy tissue from other parts of the body, surgery has made brilliant progress. Surgery is also widely utilized in the correction of deformities, such as crippled or crooked limbs.

Surgical operations require the utmost care of the patient, since any operation is a shock to the nervous system. Particular care is exercised to ward off infections. The portion of the patient's body on which the operation is to be performed is washed with soap and water; shaved, if it is a hairy part of the body; and cleansed with an antiseptic just before the operation. The entire operating room as well as all the instruments and dressings to be used are thoroughly disinfected and sterilized. The doctor and all other operating-room attendants wear sterilized garments. That these precautions are necessary is demonstrated by the enormous decrease in the death rate from operations after the application of antisepsis to surgery.

Surgery has been practiced since the time of the early Egyptians. In the Middle Ages, medicine became the province of the monks, but after a time the monks were forbidden to perform operations. Thus it was that the barbers became the surgeons, although their operations were generally limited to bloodletting. In the seventeenth and eighteenth centuries, there was a revival in the science of medicine. From this period, surgery rapidly developed as a vital branch of the medical arts. Advances in the knowledge of anatomy and physiology, the perfection of new and better instruments, and the development of new operative techniques contributed in large part to the progress of the science. In the nineteenth century two great obstacles to surgery were overcome with the introduction of anesthesia and antisepsis, and today surgery stands as one of the most valuable means for preventing and curing disease.

Consult the following titles for additional information:

Anesthetic
Antiseptic
Bacteria and Bacteriology
Disinfectants
Ether
Hospital
Koch, Robert
Lister, Joseph
Medicine
Orthopedics
Pasteur, Louis
Roentgen Rays

SURINAM, *soo ri nahm′.* Formerly known as Dutch Guiana, Surinam is the only colony of the Netherlands on the South American mainland. It lies between British and French Guiana on the northeastern coast of the continent; on the south it is bounded by Brazil. The area of Surinam is about 55,000 square miles; its population is estimated at about 250,000, including the Negroes and Indians who live in the dense southern forests. Paramaribo, the capital and largest city, has a population of about 103,000.

The people elect their own legislative council, to which the ministers, appointed by the governor, are responsible. The official language is Dutch. Lying close to the equator, Surinam produces cacao products, coffee, sugar, and bauxite.

Surinam came into the hands of the Dutch in 1667 in exchange for New Netherland (the present New York). Since then the colony has twice reverted to England for brief periods. It has been official Dutch territory since the Convention of London in 1814. The United States sent troops to assist in protecting Surinam in World War II.

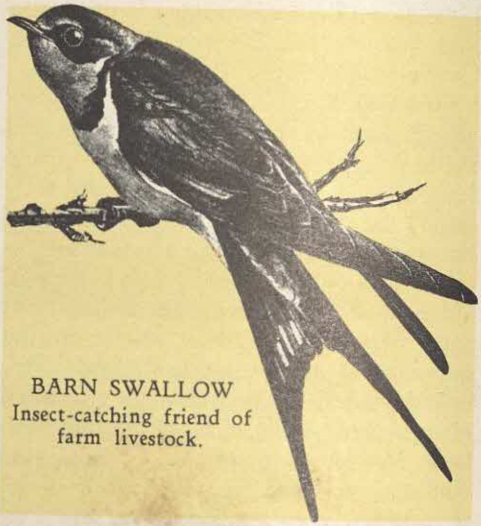
SURVEYING, *sur va'ing.* Maps for land use and charts for navigation are made from data obtained in surveying, a form of engineering through which boundaries, area, shape, contour, and general features of the earth's surface are ascertained.

There are several types of surveying, such as *land* surveying, *nautical* surveying, and *aerial* surveying. Included in land surveying are: *geodetic* surveying, which involves the examination of large areas of the earth's surface and takes into consideration the curvature of the earth; *plane* surveying, for small areas in which the curvature of the earth is not considered; and such classes of surveying as *railroad* surveying and *highway* surveying.

Nautical surveying is used for charting shoals, sand bars, depths, rocks in waterways. It is an aid to navigation. Aerial surveying has proved successful in mapping large areas of land in a short period of time. It is widely used, especially in mapping rough land. It is accomplished with the use of an automatic camera.

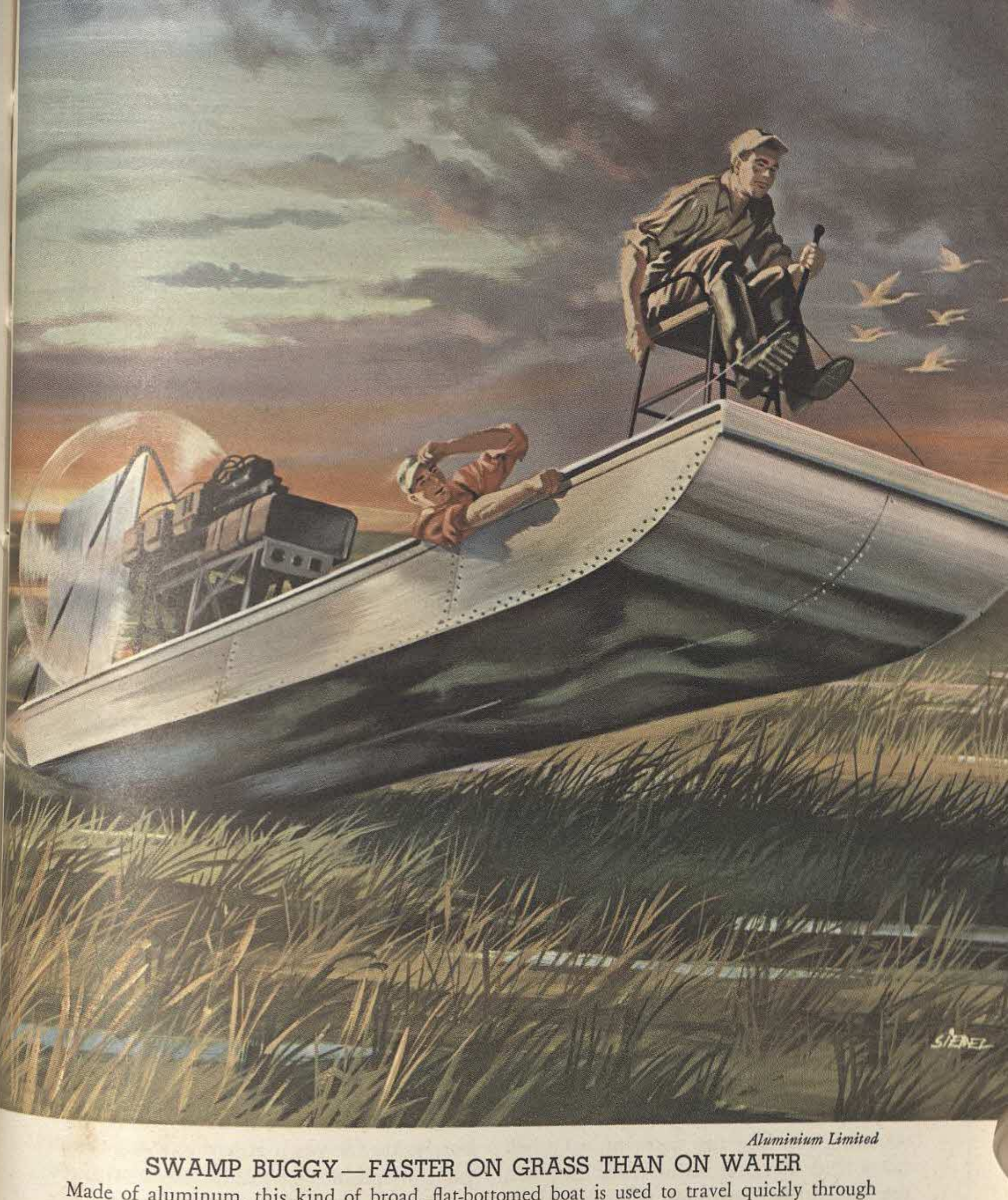
Equipment used by surveyors includes three types of theodolites, a surveyor's chain (Gunter's chain), a leveling instrument, and a leveling rod and tape. A sound knowledge of mathematics, particularly trigonometry and geometry, is necessary in surveying.

SWALLOW, *swahl' oh.* Often called the world's most graceful flier, the swallow is found almost everywhere, spending most of its time in the temperate areas and wintering in the tropics. Though their feet and legs are weak, swallows have powerful wings and remarkable flying ability. Their tails, beautifully forked, are longer than their bodies allowing them to wheel, dip, soar, and skim. Indeed, so agile are swallows that they can even take a drink while in flight.


BARN SWALLOW
Insect-catching friend of farm livestock.

They are medium-sized birds, ranging from seven and one-half to eight and one-half inches in length, with flat heads, slender bodies, and stubby, wide-opening bills. They seldom spend much time on the ground, but gather insects while in flight, thereby rendering a useful service to man. Their song consists of a pleasant twittering. They travel in pairs or colonies. The females lay three to nine brown-speckled eggs.

The backs, wings, and tails of *barn swallows* are blue gray in color, and their breasts are chestnut brown. Other well-known North American species are the *cliff swallow, tree swallow, purple martin,* and the dainty *violet-green swallow.*

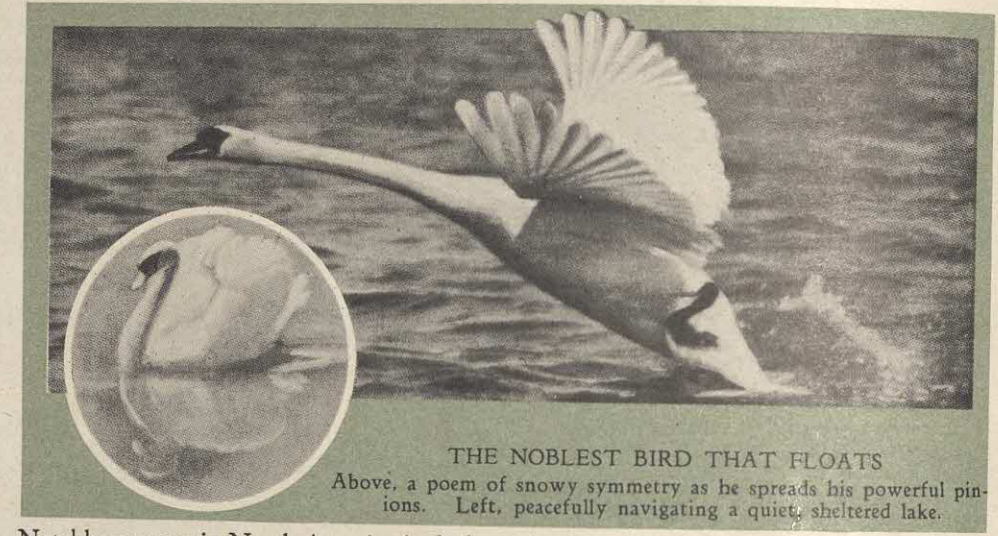


Aluminium Limited

SWAMP BUGGY—FASTER ON GRASS THAN ON WATER

Made of aluminum, this kind of broad, flat-bottomed boat is used to travel quickly through swamps where the propellers of conventional boats would tangle in the grasses.

SWAMP. Any water-soaked land, overgrown with grasses, cattails, trees, and shrubs, is called a swamp. Some have dense plant growth, but others may contain open lakes or be threaded with small streams. In general they occur where land drainage is poor. Beneath prehistoric swamps, the earth's supply of coal was formed. Many modern swamps have been drained through land improvement projects for homes, industries, and farms. However, swamp soil is often infertile. Swamps give protection to a variety of wildlife but they also are the breeding places of pests, such as mosquitoes.



THE NOBLEST BIRD THAT FLOATS

Above, a poem of snowy symmetry as he spreads his powerful pinions. Left, peacefully navigating a quiet, sheltered lake.

Notable swamps in North America include the muskeg region of Canada, the Great Lakes area, the Everglades of Florida, and the Okefinokee Swamp of Georgia.

SWAN. Belonging to the same family as ducks and geese, the swan is a large water bird, usually white, with graceful, arching neck. Two species are found in North America. Both are wild birds. The *American,* or *whistling,* swan is about four and a half feet long, with pure-white plumage, black bill and feet, and a small yellow spot in front of each eye. It nests in the Arctic regions, but is seen in Southwestern Canada and parts of the United States in winter. The *trumpeter* swan is about a foot longer and lacks the yellow spots. It ranges mostly in the interior, formerly nesting from Missouri northward, but is now rarely seen. It has a loud resounding cry like the notes of a French horn, while the calls of the whistling swan are varied and loud, but mostly high in pitch.

Swans, like geese, fly often in a V-shaped flock at great speed. They feed on water plants and seeds, and also devour mollusks, insects, and crustaceans, which they obtain from the bottom of streams and ponds by means of their long, arched necks.

The "tame" swan that is often seen in parks and private lakes is a European species known as the *mute* swan because it raises its voice comparatively little. Its bill is largely red.

SWEAT'SHOP SYSTEM. Imagine a score of people huddled about a dimly lit table in a stuffy, ill-ventilated room, where youth and old age toil side by side for twelve to eighteen hours a day in a futile effort to eke out a fair existence. This picture of the sweatshop system is not exaggerated. Now no longer common, it thrived to best advantage in crowded tenement districts, where whole families had to labor to gain a meager livelihood.

The nucleus of the system is the unscrupulous manufacturer. Rather than meet state requirements for clean, airy working conditions mandatory for factories, he gives out "home work" to a *sweater,* who hires his family and neighbors to do the work at a starvation rate of pay. Wages are generally based on piecework, and not on the number of hours. The manufacture of toys, cigars, artificial flowers, and foodstuffs, and the finishing of garments are the most common activities of the sweatshop.

Despite the fact that trade unions, labor legislation, and the restriction of immigration have partially eliminated this evil, sweatshops are still a wretched reality in city slums.

Northland Nation

Above, a thriving Bohuslan fishing village of Sweden's west coast. Left, a delightful daughter of peaceful Dalecarlia.

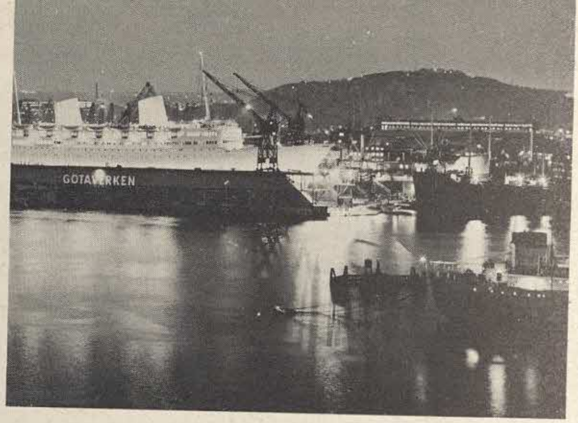
SWE′DEN. One of the Scandinavian countries, Sweden was once the home of the vikings. The modern kingdom has one of the most liberal and progressive forms of government in the world.

The country occupies the eastern and larger portion of the great Scandinavian Peninsula and has an area of 173,347 square miles. The rocky, irregular shore gives Sweden a coast line of about 4,700 miles. On the east is the Gulf of Bothnia; on the southeast and south the Baltic; and on the southwest are the Kattegat and the Skagerrak. Norway forms the western border and part of the northern; Finland forms the northeastern border.

The Land and Its Resources. Although much of the border between Sweden and Norway is formed by the Kjölen Mountains, the country is not, on the whole, a mountainous one. Among the highest peaks are Kebnekaise (6,965 feet) and Sarjektjakko (6,856 feet). Much of the land is low, remarkably level, and, in some places, marshy. Sweden has a number of fine streams which, almost without exception, flow in a southeasterly direction. The country is dotted with numerous lakes.

The climate in the southern part of Sweden is mild. January temperatures average about 25° F.; the summers are cool, with an average temperature of 63° F. in July. The far-northern part of the country is within the Arctic Circle; the winters are long and very cold, and there is almost no summer. The heaviest rainfall occurs in the south, the average being thirty-five inches annually; in the north the precipitation average is about sixteen inches.

Sweden is rich in minerals. The most important mineral is iron ore, and Sweden is one of the great iron-producing countries of the world. Other minerals include copper, lead, zinc, sulphur pyrites, and arsenic ore. There are also some coal deposits in the south.



LIFE IS VARIED IN SWEDEN TODAY

Upper left, Lucia Day is celebrated in many parts of Sweden on December 13. Lucia wears a crown of candles and brings gifts to the family in the early morning. The day commemorates an ancient legend in which Lucia brought light and food to starving Sweden. Upper right, a Swedish American liner is cradled in a drydock at Götaverken shipyards, Göteborg. Lower left, a statue of Charles X faces Malmö's town hall, built in 1546. Lower right, a farmer busy with the harvest in Skåne, southern Sweden, receives help from his daughter.

Swedish National Tourist Office

About half the country is heavily timbered with mountain ash, pine, spruce, and birch. Oak is found growing profusely in the lowland lake regions. Lumbering is an important industry.

The fisheries of Sweden, although important, are not so great as those of Norway. Salmon and herring are the principal catches, and there are numerous plants for the preparation of salted and canned fish.

Industry and Transportation. Only about twelve per cent of Sweden's area is devoted to agriculture, yet about half the inhabitants are engaged in farming. The best farm land is in the south, where sugar beets, corn, peas, beans, oats, barley, wheat, rye, potatoes, and forage crops are raised. Farms are small, the average size of farm being about twenty-five acres. Because of the excellent pasturage, livestock raising and dairying have become important industries.

Most of Sweden's manufactures are the result of the extensive iron deposits. Swedish iron and steel are in demand the world over. Glass, porcelain, motors, electrical supplies and machinery, millwork, textiles, paper, and cream separators are also important products.

Sweden has about 50,000 miles of highways. There are also more than 10,000 miles of railway, and an extensive canal system connecting the lakes and rivers provides about 2,500 miles of inland waterways. Sweden is still a nation of sailors, for not only do her ships carry Swedish imports and exports, but a large part of the commerce of other nations. Foreign trade is carried on principally with England, Germany, the United States, Norway, the Netherlands, France, and Denmark.

The People and Their Literature. Tall, well built, and usually of light complexion, the Swedes are mainly of Teutonic descent. Almost the entire population of about 7,500,000 is Scandinavian. There are about

6,500 Lapps, a large number of Finns, and a few thousand others. The capital and largest city is Stockholm, with a population of about 805,000.

The Lutheran Protestant Church is recognized as the state religion of Sweden, and most of the people are of that faith. There is, however, religious freedom.

Linnaeus, the naturalist; Swedenborg, the religious philosopher; and Bellman, the national poet, are outstanding Swedish men of letters. Swedish literature is said to have begun with the provincial laws of the thirteenth century. The fifteenth century saw the creation of many folk songs and ballads. In the following years, literature consisted chiefly of religious works. In the seventeenth century, Swedish writers began to be influenced by the works of foreign authors. Tegner, the author of *Frithjof's Saga,* is the greatest poet Sweden has ever produced. Among the modern writers are Strindberg, the playwright, and Selma Lagerlöf, a novelist who won the 1909 Nobel Prize for Literature.

Government and Education. Sweden is a constitutional monarchy, and the executive power is in the hands of the king, assisted by a Council of State headed by the Prime Minister. The king must be a member of the Lutheran Church and holds his office by heredity. The Parliament consists of an upper chamber of 150 members and a lower chamber of 230 members.

Sweden has one of the finest educational systems in the world. Elementary education is free and compulsory, and illiteracy is practically unknown. In addition to the fine system of common schools, Sweden has two excellent state-supported universities—the Royal University of Uppsala (founded 1477) and the Royal University of Lund (founded 1668); they are two of the oldest European universities. There are also in Sweden several normal and technical schools.

History. Little is known of Sweden's history before A. D. 1000. Christianity, however, was established in the ninth century. For the first three centuries of its national history, Sweden was torn by dissension between the Swedes of the north and Goths of the south. In 1397, Queen Margaret of Denmark and Norway succeeded in joining Sweden with Norway and Denmark. Although the Swedes were restive under Danish rule, they were unable to break away until 1523, when they elected Gustavus Vasa king of Sweden. During his reign, the Reformation spread through Europe and Lutheranism was officially adopted as Sweden's state religion. Following this period, the country developed rapidly.

STOCKHOLM. SWEDEN'S CAPITAL AND LARGEST CITY

Founded in 1255, Stockholm is a seaport and a shipbuilding and manufacturing center. The Göta Canal links the city with Göteborg. The old town district is Stockholm's commercial center.

Ewing Galloway

In 1611, with the ascension of Gustavus Adolphus to the throne, Sweden sprang into prominence as one of the greatest commercial and military powers of Europe. Drawn into the war in Germany through the king's defense of Protestantism, Sweden continued to flourish under Gustavus Adolphus and his successors. Sweden's power was somewhat dimmed in 1675 through a crushing defeat at Fehrbellin by Frederick William of Brandenburg. Complete ruin was averted only by hasty peace negotiations. Charles XII (1697-1718) and Gustavus III (1771-1792) again drew the eyes of Europe to Sweden through their military prowess. The next ruler, the weak Gustavus IV, was driven from the throne in 1809. Under the reign of Charles XIII (1809-1818), Sweden joined the other powers in the final overthrow of Napoleon and as a reward received Norway, formerly held by Denmark.

Bernadotte, one of Napoleon's marshals, succeeded Charles, and under him and his descendants Sweden continued to prosper. Norway succeeded in gaining her independence in 1905. Sweden succeeded in remaining neutral throughout World War I, although her shipping and industry were badly crippled. Since then, however, Sweden has prospered, and through numerous economic and social reforms has become one of the most progressive nations.

Sweden made every effort to preserve her neutrality in World War II. In the postwar world she continued to cling to the same position, refusing to take part in the North Atlantic Treaty Organization to resist Communist aggression.

Consult the following titles:

Baltic Sea
Charles, XII and XIV
Denmark
Gustavus, I, II, IV, V
Norway
Stockholm
Thirty Years' War
World War (I, II)

SWEET ALYSSUM, *a lis'um.* The sweet alyssum is a small annual which thrives in all sorts of soils, even in cold regions. Growing sometimes to a height of about eight inches, the dainty plants produce their faintly fragrant white flowers from early in the summer until frost comes. They may be cultivated either from seeds or cuttings. The leaves are small and silvery green, matting easily. There is a double variety, and also a dwarf species which is not more than four inches high. The plant is excellent for borders or for a ground cover.

SWEET'BRIER. Often called the *eglantine,* the sweetbrier is a European rose which grows wild. It has been introduced into the United States, where the spicy fragrance of its leaves and pink flowers have made it a favorite for garden and hedge.

SWEET FLAG. Ever since the time of Hippocrates, the ancient Greek physician, the aromatic root of the sweet flag has entered into the manufacture of medicine. Confectioners and perfumers also find the plant useful. It grows in moist places and on the edges of swamps throughout the Northern Hemisphere. The rushy plant has swordlike leaves and green stems, each surmounted with a spike of greenish flowers. The plant is also known as *calamus,* and is a member of the arum family.

SWEET LO'CUST. See HONEY LOCUST.

SWEET PEA. Because of their soft coloring, interesting form, and exquisite fragrance, sweet peas are among the most popular of cultivated flowers. The climbing varieties make a beautiful covering for unsightly fences.

An important point in the culture of sweet peas is to sow the seed very early in the spring. The old advice was to sow on Good Friday. Do not make a trench for sowing, but plant in rows on the level surface of the soil, covering the seeds an inch. Climbing sweet peas need a little support, such as small twigs, from the start of their growth. Keep the flowers picked, never allowing them to seed.

SWEET POTA'TO. In many parts of the American South, the sweet potato is far more familiar than the white potato and has much more economic importance. Believed to be a native of South America, the sweet potato is a member of the morning-glory family, and is widely cultivated in warm parts of the world. About ninety per cent of the crop of the United States is produced in the South, Louisiana, North Carolina, Georgia, South Carolina, Alabama, Mississippi, and Virginia being leading producers among the states.

The edible part of the plant is a tuberous root, which is wholesome, digestible, and agreeable in flavor. Its chief nutrient is starch, but sugars are also present. Baking or steaming prevents loss of sweetness, which is somewhat reduced if the roots are boiled.

Sweet-potato plants send out long trailing vines with heart-shaped leaves and flowers similar to those of the morning-glory. The crop is grown from slips, planted from roots or from vine cuttings. When kept for winter use, sweet-potato roots require warm, dry storage, and when shipped to distant markets they should be transported in heated cars.

SWEET WILLIAM, *wil'yum.* A fragrant flower belonging to the pink family, the sweet William is often seen in old-fashioned gardens. It is a biennial, and if seedlings are raised each year to replace those that die, a succession of blooms may be had for many years. The flowers occur in great clusters, and are white, salmon-pink, scarlet, and crimson. They are often variously edged and spotted.

IN THE HEART OF LILLIPUT
Swift's *Gulliver's Travels,* intended as satire, has become an adventure book for children.

AGILE CHIMNEY SWIFT
The feathered speed champion.

SWIFT. Well named are the swifts, a family of birds related to the humming birds. Their flight is remarkable for rapidity and grace, and the birds are much more at ease in air than on the ground. The typical swift is a rather small bird of plain black, gray, or brown color. It is often mistaken for a swallow, but may be distinguished by its spiny-pointed tail. Swifts have weak feet, and use their tails to prop themselves against a wall or other support. They spend much time in aerial maneuvers, snaring most of their insect fare while in full flight.

The well-known *chimney* swift breeds from Florida to Newfoundland, west to the plains. It winters south of the United States. It never perches, but spends the greater part of its time on the wing, except when clinging to the sides of a chimney or to a hollow tree with its tail for a brace. It is a sooty-colored bird, about five inches long but with narrow wings which when closed reach nearly an inch beyond the body.

The swifts formerly built their nests in hollow trees, but quickly learned to prefer the man-made chimneys. They break off twigs while in full flight, carry them to the chimney, and glue them to the inner wall with a sticky saliva. Three to six white eggs are laid.

SWIFT, Jonathan (1667-1745). In 1726 appeared *Travels into Several Remote Nations of the World,* by Lemuel Gulliver, the book better known as *Gulliver's Travels.* Jonathan Swift was revealed as the author of this clever satire on the life and politics of his time in England and Ireland, and it is today the best known and most widely read of his works.

Swift was born in Dublin shortly after his father's death, was cared for by an uncle, and received his education at Kilkenny School and Trinity College, where he was graduated. From 1689 to 1694 he was secretary to Sir William Temple at Moor Park in England. During this period he had studied at Oxford and received an M.A. degree. He entered the service of the Protestant Church of Ireland and secured a prebend near Belfast, but shortly returned to Sir William and remained with him until 1699.

Again Swift became a rector near Dublin, and in 1701 received a D.D. degree there. His attention was drawn to political life, and he spent much time in England. He was a relative of Dryden, and a close friend of such men as Addison and Pope. At first an adherent of the Whig party, he later took up the Tory cause and used his pen forcefully in the *Examiner,* a Tory journal. As a reward for his loyal support, his friends induced Queen Anne to give him an appointment as dean at Saint Patrick's Cathedral in Dublin. After her death he retired to Ireland, where he spent the remaining years of his life as dean, at the same time continuing to depict with his keen mind and matchless style the political and social ills of Ireland.

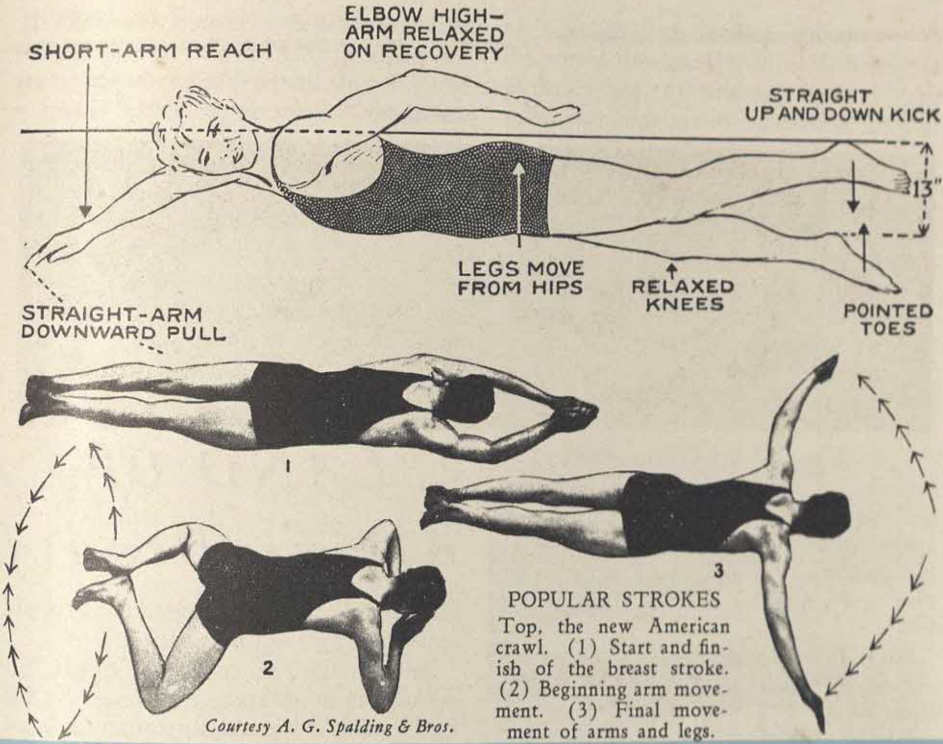
Among his works, other than *Gulliver's Travels,* are *The Battle of the Books, The Tale of a Tub,* the pamphlets *Argument Against the Abolishing of Christianity* and *A Modest Proposal,* the *Drapier Letters, Journal to Stella,* and the poem *Cadenus and Vanessa.*

SWIM'MING. The art of swimming undoubtedly was an activity as important as running and walking even in prehistoric days. The very existence of our ancestors often demanded that they have the ability to swim creeks, rivers, and bays.

Swimming is the art of moving the body through the water by propelling with hands and feet. Floating is the art of lying motionless on top of the water. There are various strokes that may be used, including the side stroke, back crawl, breast stroke, and crawl.

As a form of physical exercise, swimming is very important, for it brings into play many body muscles not used in other forms of exercise. Swimming is often a valuable means of saving life—of others as well as oneself—and it ranks high as a form of recreation and wholesome play.

Learning to Swim. The swimming strokes are the last things which a swimmer should learn. The beginner should experiment with the effect of various positions in the water, with a foot or hand on the bottom if he likes, or grasping a floating board, or wearing water wings or a life preserver. He should get accustomed to the fact that when he lowers his head his feet come up, and when he lowers his feet his head rises. Above all, he should


ELBOW HIGH—ARM RELAXED ON RECOVERY
SHORT-ARM REACH
STRAIGHT UP AND DOWN KICK
13"
LEGS MOVE FROM HIPS
RELAXED KNEES
POINTED TOES
STRAIGHT-ARM DOWNWARD PULL
1
2
3

POPULAR STROKES

Top, the new American crawl. (1) Start and finish of the breast stroke. (2) Beginning arm movement. (3) Final movement of arms and legs.

Courtesy A. G. Spalding & Bros.

SWIMMING — GREATEST OF BODY-BUILDING SPORTS

Not only does this popular pastime develop muscles; it is often a means of saving life.

learn to relax completely every muscle that is not producing motion.

Secondly, the beginner should practice breathing in through his mouth, quickly, and out through his nose, slowly, until it is "second nature." If he does this with his face alternately out of and in the water, and with his body in various positions (but always relaxed), he has almost learned to swim.

SWIN'BURNE, Algernon Charles (1837-1909). A notable figure in the Pre-Raphaelite group of English artists and poets was Algernon Charles Swinburne. Born in London, in his youth and while at Oxford he was an ardent student of classical literature, poetry, and drama, and devoted himself to serious efforts at writing immediately upon leaving the university.

His poetry possesses a rare lyric beauty. Characteristic of the period are the countless references to Greek mythological characters and legends. It was the idea of the Pre-Raphaelites that beauty could only be found in the arts before the days of Raphael. When only twenty-three, Swinburne produced two dramas, *The Queen Mother* and *Rosamond*. From 1866 to 1881 he wrote three plays based on the life of Mary, Queen of Scots, entitled *Chastelard, Bothwell,* and *Mary Stuart.* Among his other poetical works are *Atalanta in Calydon, Poems and Ballads, A Song of Italy, Songs before Sunrise, Erechtheus, Songs of the Spring Tides,* and *Astrophel.*

SWINE. See Hog.

SWISS GUARDS. Because of their exceptional bravery, Swiss soldiers have often served as the special guards of royalty. The most famous body of Swiss Guards consisted of a unit of soldiers who acted as guards for the royal family of France under Louis XVI. In 1792, during the French Revolution, these Guards were wiped out by a mob that stormed the Tuileries. As a memorial to their heroism, Thorwaldsen's *Lion of Lucerne* was sculptured in stone at Lucerne, Switzerland. A similar guard, organized to protect Louis XVIII, was crushed in the Revolution of 1830. The Swiss Guards of the Vatican at Rome are commonly known as the Papal Guard.

LAND OF *Alpine Beauty.*

SWITZERLAND. This small republic has long attracted visitors the year around. In winter and summer alike, its bracing climate, snow-capped peaks, and beautiful mountain lakes are delightful.

Like Hungary, Switzerland has no seacoast. Germany lies to the north and east, France to the west, Italy to the south. The tiny Principality of Liechtenstein lies between Switzerland and Austria. The area of Switzerland is 15,944 square miles; the population, about 5,185,000.

Physical Features. In general, Switzerland may be said to have three geographical divisions: the Jura Mountains, the Alps, and a plateau lying between the two mountain ranges. The Juras stride across the northwest section of the country, a part of the range forming a natural boundary between France and Switzerland. The Alps occupy the entire southern and southeastern sections, taking up approximately sixty per cent of the area of Switzerland.

Between the two mountain ranges lies the plateau at an average altitude of 1,300 feet. The most spectacular scenery is found in the Alpine range where rise Jungfrau, the Matterhorn, and Monte Rosa. Mont Blanc, on the Franco-Swiss border, is the most famous Alpine peak. The slopes of both the Juras and the Alps are heavily timbered; in the valleys below are the rich pasture lands.

Myriads of icy mountain streams fed by melting snows dash down the slopes; and, although useless for navigation, they provide Swiss factories with abundant water power. The Rhine, the Rhone, the Ticino, and the Inn rise within the Swiss boundaries. Among the more prominent of Switzerland's lovely lakes are Geneva, Constance, Lucerne, Neuchâtel, and Zürich.

Climate. Both climate and rainfall vary with the altitude. In the valleys the average precipitation is thirty-three inches; in the higher regions it is much greater. Although the temperature in the lower regions averages about 68° F., the climate of the higher valleys is more severe. The snow line occurs between 9,000 and 10,000 feet above the sea.

Natural Resources. Switzerland's greatest natural resource is water power furnished by the many streams. Minerals are few in number, salt, iron ore, manganese ore, and asphalt being the most important. There is also considerable timber, mostly pine.

Industry and Transportation. Only a small percentage of the land is farmed; most of the useful remainder is devoted to forests and pastures. Dairying is an important type of farming, with cheese and condensed milk the leading products. Wheat, rye, tobacco, grapes, olives, and vegetables are also grown, but a good deal of food must be imported.

Highly developed industries produce dairy products, clocks and watches, chocolate, textiles, lace, machinery, chemicals, beer, and wine. Wood carving is a unique Swiss handcraft. Much of the fuel and raw materials for manufactures must be imported by the Swiss.

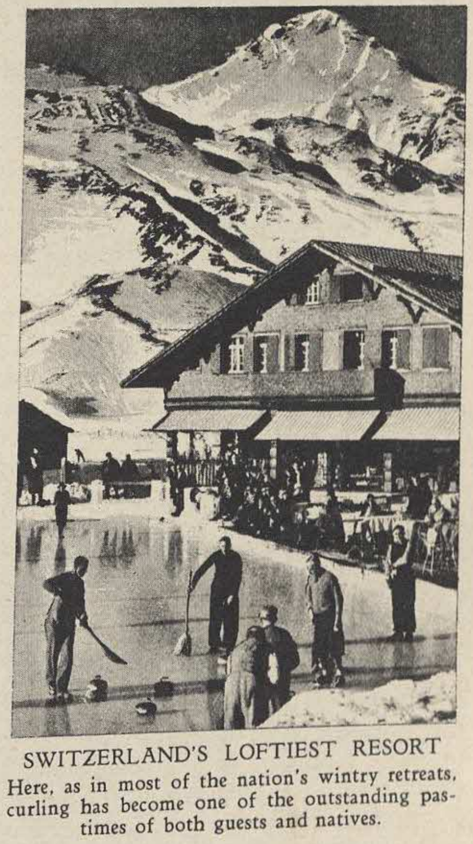
There are 3,500 miles of highly improved railways in the nation; these are augmented by 10,200 miles of excellent highways. Air travel is being rapidly developed. Motor roads and narrow-gauge railways make the Alpine regions accessible.

People. If there is any one outstanding characteristic of the Swiss people, it is their traditional fervent love of liberty—in spite of the fact that the population is made up of people of both Teutonic and Latin descent. There is no Swiss language. German is spoken by about sixty per cent of the people and French by about twenty per cent; there are also many who speak Italian or Romansch. All four of these languages are recognized as official.

About fifty-seven per cent of the people are Protestants, forty-one per cent Catholic; the remainder are of Jewish and other faiths. Primary education is free and compulsory. Besides the common and high schools, there are numerous trade and technical schools and seven fine universities. The oldest university, the one at Basel, was founded in 1460.

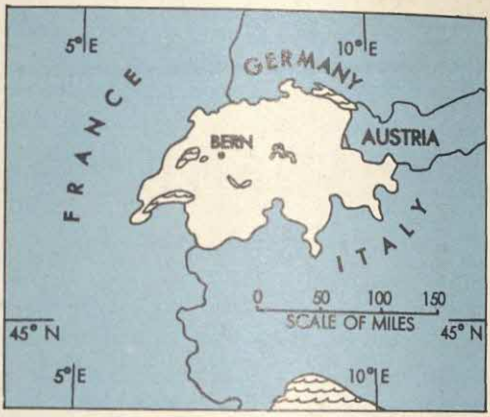
Zurich, located on the lake of the same name, is the largest city in Switzerland and has a population of about 418,000. Other large cities are Basel; Bern, the capital; and Geneva, home of the League of Nations until 1946.

A Perfect Democracy. Nowhere else in the world is there a more perfectly balanced republic than Switzerland. Each of the twenty-two cantons is a self-governing unit but is a part of the Swiss Confederation. The legislative body, or Federal Assembly, consists of two houses: the Council of States of forty-four members, two from each canton, and the National Council of 196 members chosen by popular vote, one for each 22,000 people. The Assembly elects a Federal Council of seven members to serve for four years; the President of this Council, elected annually, also serves as President of Switzerland. The people have the right of referendum; that is, they



SWITZERLAND'S LOFTIEST RESORT

Here, as in most of the nation's wintry retreats, curling has become one of the outstanding pastimes of both guests and natives.



MOUNTAIN REPUBLIC
At the left is the historic sixteenth-century townhall in the Swiss city of Basel. Above is a location map of Switzerland, lofty stronghold of peace and independence.

may vote for or against any law passed by the Federal Assembly if 30,000 citizens or eight cantons demand such action.

All able-bodied men up to the age of sixty must stand ready for military service. After his initial training, each recruit must take a "refresher" course annually for a number of years. There are few exemptions besides those for the physically unfit, and all those exempted must pay a special tax.

History. The early inhabitants of Switzerland were the Helvetians and Rhaetians, who were conquered by Caesar in the first century B. C. Later came a wave of Germanic tribes who were, in turn, subdued by the Franks. Still later the territory was split between France and Germany; but eventually all Switzerland fell into German hands and became a part of the Holy Roman Empire.

During the Middle Ages, the Swiss were greatly oppressed by the House of Hapsburg; in 1291 the people of Lower Unterwalden, Uri, and Schwyz joined in a league of defense which was the beginning of the Swiss Confederation. The first actual fighting broke out in 1315, when the Hapsburgs were defeated at the Battle of Morgarten. In the years following, the Swiss union was joined by the cantons of Bern, Zug, Zurich, Lucerne, and Glarus, a strengthening which enabled the Swiss to defeat the Austrians again at Sempach in 1386 and at Nafels in 1388. The Swiss followed up their advantage by seizing Thurgau and Aargau.

A war with Charles the Bold of Burgundy came in 1476, the Swiss again being victorious. In 1499 Maxmilian I of Austria attempted to regain Switzerland, but failed. From that time on, the Swiss were practically an independent people, although not officially recognized as such until 1648. By 1513 the Swiss Confederation included thirteen cantons.

The spread of the Reformation through Switzerland brought about civil war. During the seventeenth and most of the eighteenth centuries, Switzerland was torn by internal political and religous dissensions. In the closing years of the eighteenth century, the French Revolution spread into

Switzerland, and the Helvetic Republic was formed in 1798. It lasted for only a few years and was replaced by a new confederation of nineteen cantons which was recognized in 1815 as an independent and perpetually neutral nation. In 1848 a new Constitution was adopted. It was superseded by the present one in 1874.

Throughout both World Wars, Switzerland remained neutral. The League of Nations, formed after World War I, had its headquarters in Geneva until 1946, when the newly formed United Nations took over its major functions.

Consult the following titles:

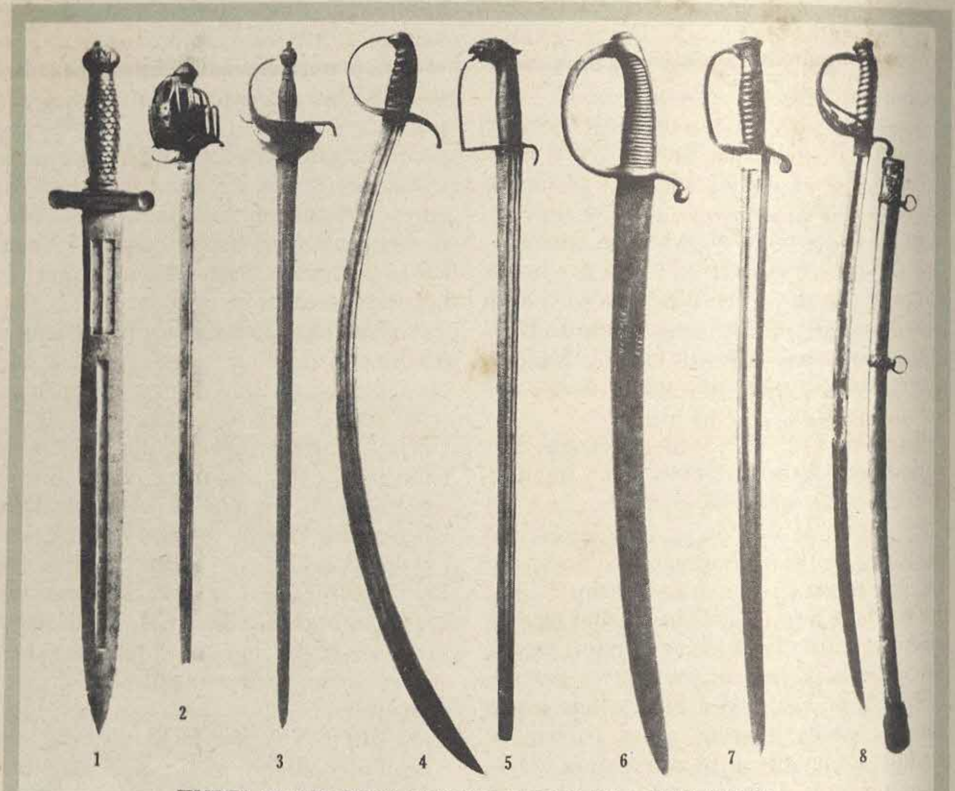
Alps
Calvin and Calvinism
Chillon
Geneva
Jungfrau
Matterhorn
Mer de Glace
Reformation, The
Rhine
Rhone
Saint Bernard, Great
Saint Gotthard
Simplon
Tell, William

SWORD, *sord*. Man first created swords when he learned the art of making metal. All these weapons consist of two parts—a handle, or *hilt,* and a blade. The blade may be either long or short, curved or straight, and with one or two cutting edges. The earliest swords known, used by the Assyrians, Greeks, and Gauls, were of bronze; then iron was discovered and used. Roman swords, short, sharply pointed, and with two cutting edges, were of the finest steel. With the coming of gunpowder, the sword lost ground as an important weapon, though light rapiers were still retained for dueling.

Modern warfare makes little use of the sword. The Japanese use a two-edged sword about thirty inches long. In Western countries, long swords, or sabers, are used by cavalry troops. The dress sword of army and navy officers is worn on formal occasions as an emblem of rank. With the decline of cavalry, about the only form of the sword used in battle today is the bayonet, attached to a rifle for desperate hand-to-hand fighting.

Swiss Information Bureau

A SWISS MAID: A SWISS METROPOLIS
Above is a dainty native of the Bernese Oberland; below is Zurich, largest of Swiss cities.



TYPES OF SWORDS OF THE PAST FIVE CENTURIES

(1) American foot-artillery sword, 1830-70. (2) Scottish cavalry sword, early nineteenth century. (3) Sword of early Spanish explorers. (4) Hessian Revolutionary sword. (5) War of 1812. (6) French infantry sword, 1800. (7) Confederate sword. (8) Cavalry saber, Civil War.

SWORD'FISH. Found chiefly in the Atlantic, but also present in the Pacific, the swordfish is an interesting specimen of marine life. It is a strong, fast-moving fish with an upper jaw flattened and elongated to form the swordlike structure which gives it its name. The sword is about half the length of the body and strong enough usually to cut into a rowboat or sailing boat. Cutting into boats, however, although it sometimes happens, is accidental. The real function of the sword is to kill small fish that occur in schools, such as the herring and menhaden, which form the principal food of the swordfish.

The average Atlantic swordfish weighs around 250 pounds and is about seven feet long; the largest are found off the New England coast, where every year from 3,000 to 6,000 are caught. Because their flesh is a food of excellent flavor, and also because they are such game fighters, harpooning the swordfish is considered one of the keenest and most thrilling of fishing sports.

SYCAMORE, *sik' a more.* Among the interesting trees of North America are the sycamores. The common species, also called *buttonwood,* is easy to recognize because of the peculiar chalk-white appearance of the branches where the tree has shed its bark. This characteristic is so striking that even an amateur may recognize the tree quickly and at a considerable distance. The tree not infrequently reaches a height of 150 feet and often has a trunk nearly ten feet in diameter. The leaves are coarsely and sparsely veined, and somewhat resemble a maple leaf. When young they are densely hairy beneath. Distinctive also are sycamore fruits, round seed balls hanging on long stems.

Sycamore wood is hard and coarse-grained. It splits with much difficulty and is used a great deal for butchers' blocks. It is not very durable, but is used to some extent in interior finishing and in furniture. Its value as a decorative wood lies in the large structures (medullary rays) which run from the center toward the outside. The wood may be so cut as to make these bring out pleasant contrasts with the rest of the wood.

SYD'NEY, New South Wales. The oldest and largest city in the Commonwealth of Australia is Sydney, capital of New South Wales. It is situated on Port Jackson, the great harbor of Sydney, one of the deepest and finest in the world. The harbor reaches inland for a distance of twenty miles and gives the city a water frontage of almost 190 miles. There are more than twenty miles of wharves and docks. A huge arch bridge with a span of 1,650 feet extends across the harbor.

In the old section of Sydney there are still some narrow, winding streets, although much of this section has been rebuilt and modernized. The new sections, however, are thoroughly modern. As Sydney has grown, its residential sections have spread out into a number of beautiful suburbs, thus preventing overcrowding and slums.

Of particular interest in the city are the University of Sydney, the Parliament and other government buildings, two cathedrals (one Roman Catholic and one Anglican), and many fine parks, including the botanical gardens.

An industrial city, Sydney manufactures machinery, clothing, metal products, and food products. It is the most important wool market in all Australia.

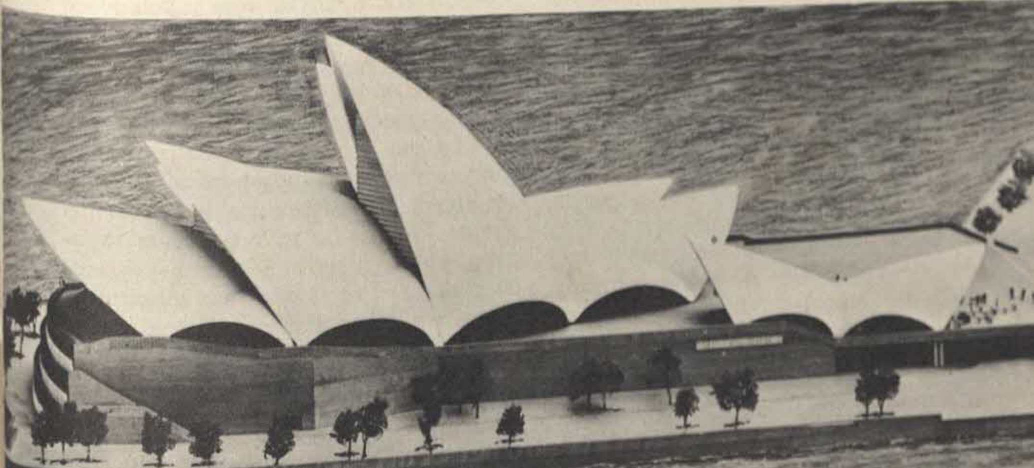
The settlement of the present site of Sydney was the beginning of the British settlement of Australia. That was in 1788, when a shipload of convicts arrived, sent by the British government. In 1938 the 150th anniversary of that occasion was celebrated in Sydney. Today the little settlement has grown into one of the great cities of the world, with a population of more than 1,975,000.

SYMPHONY, *sim' fo ni.* The highest type of orchestral music so far developed is undoubtedly the symphony, a composition in sonata form. A number of the world's greatest cities have symphony orchestras, and as some of them travel during part of

CONCRETE SAILS FOR WATERFRONT OPERA HOUSE

A series of white concrete shells, which form the roof of this auditorium on the harbor front in Sydney, resemble the billowing sails of small craft that skim near by. The opera house was designed by a Danish architect who won first prize in a world-wide competition.

Australian News & Information Bureau



each season, many people in the United States and Canada have become familiar with symphonic music.

The great classical masters of the symphony were Beethoven, Mozart, Mendelssohn, Haydn, and Schubert, all Germans. Of these, Beethoven was the greatest of all. To listen to his *Fifth Symphony* (or any of his best) is to a musically minded person a wonderful experience. More recent composers who have written great symphonies are Brahms (German), Dvorák (Bohemian), Tschaikovsky (Russian), and Sibelius (Finnish). See MUSIC; ORCHESTRA; SONATA.

SYNAGOGUE, *sin'a gog*. More than 2,500 years ago, when thousands of Jews were transported bodily from Palestine to Babylon, the synagogue came into being as a place of worship for the captive people. The synagogue is still in existence; and today, besides fulfilling its original mission, it is also the center of culture in many Jewish communities.

Modern synagogues, attended by Orthodox Jews, have retained some of the traditions which grew up about them in the early years of the Christian Era. They were so constructed that the worshipers entered and prayed facing in the direction of Jerusalem. The Holy Ark was located at the east end, and in front was a platform for the reader. Separating the congregation was a partition which divided the men from the women.

A particularly important aspect of the synagogue was the fact that the sacred offices were not hereditary as in the case of the Temple of Jerusalem, but officials were elected by the congregation which had the final say in all matters. Excommunication, however, rested with a college of elders. On week days, one of the officials of the synagogue acted as teacher, and during the Middle Ages the synagogue was the only place where many Jews could receive an education. It was customary, however, to allow anyone to address the congregation, and free speech was somewhat tolerated.

It is said that Ezra, after the return of the Jews from the Babylonian captivity, presided over the Great Synagogue, an assembly of 120 members. See TEMPLE.

SYNOD, *sin' ud*. See PRESBYTERIAN.

SYR'ACUSE, N. Y. Situated on low hills at the south end of Onondaga Lake is Syracuse, the fourth largest city in New York state, and the county seat of Onondaga County. It became well known early in its history because of its location at the junction of the Erie and Oswego canals. Syracuse is beautifully located and has been well planned. The people of the city are especially proud of their extensive system of parks. Many of the parks are really only small squares, but there are several large ones, including Thornden Park and Burnet Park.

Among the important buildings are the courthouse, the city hall, and the public library. Here also are located Syracuse University, a museum, and the New York State Fair grounds.

The industry and commerce of Syracuse were greatly stimulated by the Erie Canal, now a part of the New York State Barge Canal. Although the canal is no longer so important as it was formerly, the city's industrial growth has continued because of its location and near-by natural resources. There are several hundred industrial plants in the city, and near by is the Solvay Process Company, employing thousands of workers and producing soda ash, caustic soda, bicarbonate of soda, coke, ammonia, and carbolic acid. Extensive salt and lime deposits are near the city. The principal manufactured products of Syracuse include clothing, tool steel, hardware, automobiles, china, farm machinery, shoes, and typewriters.

The site on which Syracuse stands was once occupied by a village of the Onondaga Indians. Champlain visited it in 1615. The town itself was begun in 1805 but did not become important until the completion of the Erie Canal. Syracuse was incorporated as a village in 1825 and was chartered as a city in 1847. It has adopted the mayor and council form of government. The population is over 218,000.

By Deane Dickason, from Ewing Galloway, N.Y.; Ewing Galloway, N.Y.

BETWEEN THE NEW WORLD AND THE OLD IN SYRIA

The ancient and the modern merge in Damascus. Both street scenes show this Syrian city.

SYR'IA. One of the oldest inhabited regions in the world is Syria, in general a barren little country at the eastern end of the Mediterranean Sea. It has long held a position of importance because it has long served as a route of land travel between East and West. For thousands of years Asiatic and European armies, travelers, and traders skirted the edge of the Mediterranean Sea through the mountain passes and low coastal lands of Syria. The country is steeped in history and legend, particularly its capital, the famous old city of Damascus. Countless battles have been fought on its soil for control of this all-important overland route.

Syria, since 1958 a part of the United Arab Republic, is bounded by the nations of Turkey, Iraq, Jordan, Israel, and Lebanon. Part of it lies within the Fertile Crescent, the cradle of ancient civilizations. Syria does not have great mineral wealth. There are deposits of oil, building stone, and marble. The people engage in farming. Some of the main products are wheat, corn, barley, sorghum, silk cocoons, and cotton. Fruit is raised in large quantities, the most important fruit trees being the olive, mulberry, lemon, banana, and orange. The only manufactures of importance are flour, silk thread, and soap. A considerable foreign trade is carried on through the ports on the Mediterranean coast.

After World War I, Turkey was forced to give up Syria, which was mandated to France. The Republic of Syria was established in 1925, and a Constitution was adopted in 1930, providing for a President and legislature. In 1936, treaties promising the Syrians their independence were concluded, but were not ratified by the French Parliament. The British and Free French defeated the Vichy French in Syria in 1941. Syria and Lebanon were proclaimed independent republics, but it was not until 1944 that the republics were formed.

On February 1, 1958, Syria and Egypt united to form the United Arab Republic with Gamal Nasser as President. The kingdom of Yemen is federated with the republic, but is not part of it. Syria contains about 73,500 square miles. Its population is about 4,100,000.

SYR'IAC. Although the pure Syriac language has long been extinct, it was once one of the important branches of Aramaic, which belongs to the Semitic family of languages. It was used extensively during the early Christian Era, being the native language in the region about Edessa, a center for Eastern Christians in the second century. The Bible and other Christian books were translated into Syriac, and it became recognized as the language for scholars. It was used for works in history, science, grammar, medicine, and philosophy. See SEMITIC LANGUAGES.

T ◆ In the family of letters, *T* is a close relation of *D*, for the two are pronounced almost alike and are interchanged in various languages. The twentieth letter of our alphabet, *T* came originally from the Phoenicians, who wrote it ✕. The Greeks and, after them, the Romans wrote *T* as we do, except that the letter was somewhat rougher and cruder in appearance.

TABERNACLE, *tab'ur naḳ'l.* The Bible relates how, in their many years of wandering in the wilderness, the Israelites carried their own church, or tabernacle, from place to place. On arriving at a new site, the structure would be erected in the center of the camp. According to the Bible narrative, God watched over it by day in the form of a cloud and by night as a blazing column of fire. The tabernacle was in the direct charge of the Levites, and was dedicated the second year following the emigration of the wanderers from Egypt. It was still in use at the time of the building of Solomon's Temple.

Although tentlike in form, the tabernacle actually resembled a house, for three of its sides were enclosed with heavy gilded boards of acacia wood. The front of the edifice, which always faced the east, was heavily draped with curtains. The overlying canopy was of fine linen, covered over with skins. Acacia pillars formed the entrance. The tabernacle was divided by a curtain into two parts, the Holy Place and the Holy of Holies. The latter, entered but once a year by a high priest, contained the Ark of the Covenant, in which Moses placed the Ten Commandments.

Rectangular in shape, the tabernacle was about forty-five feet long and fifteen feet wide; it was surrounded by a court 150 feet long and seventy-five feet wide. Near the entrance to the tabernacle stood an altar where burnt offerings were made; near by was the laver where the priests bathed their hands and feet before entering the holy edifice.

TABERNACLES, Feast of. Comparable to our Thanksgiving is the Feast of Tabernacles, a time of rejoicing among orthodox Jews the world over. The celebration, lasting a week, begins on the fifteenth day of the seventh month (Tishri). In addition to being a form of harvest festival, it commemorates the early days of the Jewish people, when the tribes lived in tents. Among the ancient Jews, the feast marked the end of the fruit harvest. The people congregated at Jerusalem and dwelt in booths covered with thatch. This feature of the celebration is still observed, in as far as it is practicable.

TA'BOR, Mount. To the northeast of the plain of Esdraelon rises Mount Tabor, 1,843 feet above sea level and isolated from any other mountains. From its summit, the Sea of Galilee and the surrounding country, with its quaint villages, are spread before one. Only seven miles to the northwest lies the town of Nazareth, the boyhood home of Jesus, and Tabor has been revered as the supposed site of the Transfiguration of Christ. In early times a fortress is believed to have occupied its summit; indeed, recent excavations reveal traces of structures that stood there centuries ago.

TACITUS, *tas' e tus,* PUBLIUS CORNELIUS (about 55-120). A famous historian of ancient Rome was Publius Cornelius Tacitus, who lived during the period of the expanding empire. He served in numerous important public offices—as quaestor under Titus, as praetor during the reign of Domitian, and as consul under Nerva. A close friend of Pliny the Younger, Tacitus married the daughter of Agricola, who subdued the rebellious tribes of Britain.

The first writing attributed to Tacitus is the *Dialogus de Oratoribus,* presumably published about the year 75. In 98 he produced *Agricola,* a concise biography of his illustrious father-in-law. In the same year he brought out his *Germania,* still an accepted authority on the customs, habits, and political practices of the early Germanic peoples. Of his *Historae,* which vividly depicted the military activities of his time, only a few volumes remain. His greatest work, the *Annales,* recounts events in the reigns of Tiberius, Claudius, and Nero. Of the original eighteen volumes, there remain but twelve, complete or in part.

TAD'POLE. Sometimes, when walking beside a pond, we see in shallow water little egg-shaped creatures with conspicuous tails; these are tadpoles, frogs in the larval form. Polliwogs, as the tadpoles are called, develop from eggs. See FROG.

TAFT, WILLIAM HOWARD (1857-1930). No man in the history of the United States held more important government posts than William Howard Taft, twenty-seventh President and former Chief Justice of the Supreme Court.

Taft was a brilliant jurist, and what he did reflected the judicial point of view. He preferred to move slowly and surely, keeping in mind the long-range aspect of every situation. Because of this characteristic he was regarded as a conservative by people who had become accustomed to the aggressive methods of Theodore Roosevelt. However, in the years that followed his Presidency, he regained the confidence of many, including some of his most bitter political enemies. As a jurist and administrator, he fared much better than as the executive head of the American government.

WILLIAM HOWARD TAFT

Much more capable as a jurist than as Chief Executive of the nation, Taft was a staunch advocate of the League of Nations and served for nine years as Chief Justice of the United States Supreme Court. His was a conservative administration.

Early Career. William Howard Taft was born on September 15, 1857, in the city of Cincinnati. He was graduated with honors from Yale in 1878. In 1880 he completed his legal preparation at the Cincinnati Law School, standing at the head of his class. In 1887 he became a judge of the Ohio Superior Court, and three years later was appointed Solicitor General of the United States by President Harrison.

From 1892 to 1900, Taft served as judge of the sixth circuit of the Federal Court of Appeals. Following the annexation of the Philippines by the United States, in 1900, President McKinley appointed him head of the civil commission created to govern the islands. A year later, Taft became the first civil governor of the territory. Offered a place on the Supreme Court bench in 1903, by President Theodore Roosevelt, Taft declined, but he accepted the appointment of Secretary of War the following year. When Cuba was stirred by internal revolt in 1906, Taft served as temporary governor of the island, and a short time later concluded important negotiations in Panama, the Philippines, Japan, China, and Russia.

The Presidency. Roosevelt and his Secretary of War were close associates, and there was little doubt whom the President would suggest as his successor. Teamed with James S. Sherman, Republican candidate for Vice-President, Taft defeated the Democratic candidate, William J. Bryan, by a decisive popular and electoral vote in 1908. At the outset it appeared as though the new President were going to carry out the policies of Roosevelt, but before very long it became apparent that Taft was following a conservative course. When he approved the Payne-Aldrich Tariff Act, which failed to lower tariff rates, and then proceeded to defend the law publicly, the liberal element in the Republican party openly expressed dissatisfaction.

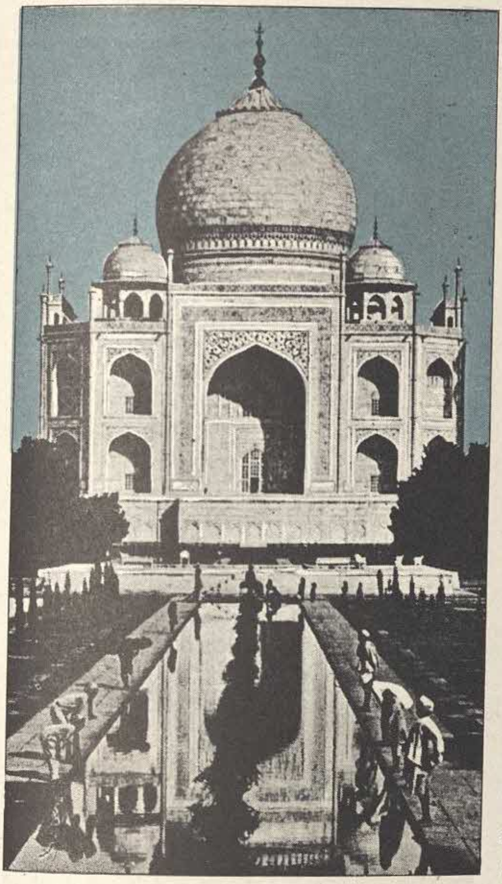
In several questions involving government personalities, Taft remained more or less neutral, causing additional criticism. Gifford Pinchot, head of the Division of Forestry, charged Secretary of the Interior Richard Ballinger with dishonesty in the administration of the public lands in Alaska. When Pinchot appealed to the President, Taft removed him from office. The public sided with Pinchot, although a congressional inquiry cleared Ballinger of the charges.

Notable events of the administration included: the organization of the postal-savings system (1910) and the inauguration of the parcel post (1912); enactment of a law providing for a separate Department of Labor; and the adoption by Congress of the Sixteenth and Seventeenth amendments, providing for the levying of income taxes and the popular election of Senators. The Roosevelt Dam was completed, and numerous trust cases were successfully handled. Taft followed Roosevelt's policies along "trust-busting" lines, and the Standard Oil and tobacco trusts were dissolved.

In the field of foreign diplomacy, President Taft worked in behalf of world peace and of reciprocity treaties. The Atlantic fisheries dispute with Canada was settled, and "dollar diplomacy" became a part of America's foreign policy. In other words, international good-will was created by the furthering of commercial relations and financial investments in the Pan-American and Oriental countries.

By 1912 a distinct cleavage had taken place in the Republican party. When Taft was nominated for re-election, the Progressives bolted the convention and held a separate meeting, nominating Theodore Roosevelt as President. Roosevelt's popularity split the Republican vote, giving the election to Wilson, the Democratic candidate. Taft secured but eight electoral votes, Roosevelt, eighty-eight, and Wilson, 435.

NEST OF THE TAILOR BIRD
This talented little warbler takes unusual pains in concealing his home in dense foliage.



THE BEAUTIFUL TAJ MAHAL

As Ex-President. After his defeat, Taft accepted the post of Kent professor of law at Yale University. In 1916 he was elected chairman of the Central Committee of the American Red Cross. The following year he was made president of the League to Enforce Peace, and he later supported the League of Nations. In 1921 President Harding appointed him Chief Justice of the Supreme Court. He capably served in this capacity until 1930, retiring a short time before his death. See ROOSEVELT, THEODORE.

Robert Alphonso Taft (1889-1953), eldest son of William H. Taft, was born in Cincinnati, Ohio. After completing his preparatory schooling at the Taft School, Waterbury, Conn., he entered Yale, graduating in 1910. In 1913 he received his degree in law at Harvard. In 1936, Yale University awarded him the M.A. degree.

Having established a successful law practice in Cincinnati, Robert Taft became active and influential in the business, civic, and political life of the city. He was assistant counsel of the United States Food Administration during World War I, and in 1921 was elected to the lower house of the Ohio legislature. In 1926 he served as speaker. In 1931-32, Taft was a member of the Ohio senate.

Ohio, strongly Democratic in the elections of 1932 and 1936, elected a Republican governor and a United States Senator in 1938. The new Senator was Robert Taft. In the United States Senate he displayed a sound understanding of national affairs, and was prominent in debate. He was reelected to the Senate in 1944 and 1950. Taft was a leading contender for the Republican nomination for the Presidency in the campaigns of 1940, 1944, 1948 and 1952.

TAHITI, *tah he'te*. Largest and most important of the Society Islands, a French group in the Eastern Pacific, is the picturesque island of Tahiti. It has an area of 600 square miles and contains the town of Papeete, which is the capital of the French Pacific Islands. The Society Islands, the Marquesas and Tuamotu groups, and several other island groups form a French colony. See SOCIETY ISLANDS.

TAIL'OR BIRD. The "seamstress of the bird family," the tailor bird is actually one of the warblers. Its nest, formed of cotton, down, or soft grass, is encased in one or two large leaves, stitched together with thread or fiber by the bird's slender bill. The back of the tailor bird is olive green, with white under parts and a crown marked with chestnut. It is a native of the Orient, particularly India and the Malay Peninsula. See WARBLERS.

TAJ MAHAL, *tahj ma hahl'*. In all the world the Taj Mahal remains the finest example of monumental architecture. It was erected outside the city of Agra in Northern India by Shah Jahan, as a tomb for his favorite wife Mumtaz-i-Mahal, called "Crown of the Palace." Built of white marble, this beautiful edifice is 186 feet square and stands in the center of a court 313 feet square. Surmounting the structure in the center is a great dome 210 feet high, with a diameter of fifty-eight feet; and there is a smaller dome on each of the four corners of the building.

The exterior is exquisitely carved with arabesques and inscriptions and inlaid with semi-precious stones. No artificial light is necessary for the interior, a dim illumination filtering through the trellised openings in the upper walls. On each corner of the surrounding court a graceful minaret points skyward. The Taj Mahal stands within a walled garden planted with cypress and graced with lovely fountains and pools.

TALC. Because it feels soapy to the touch, this soft, white-to-greenish mineral is often called *soapstone*. It is a silicate of magnesium. It forms extensive beds in some localities, and is the alteration product of certain harder magnesium minerals. It is often associated with schist and dolomite.

Talc is used for many purposes—in the manufacture of cooking utensils, heating stoves, furnace linings, fireproof paints, paper, and wall plasters; in the textile industries, and as a filler in making rubber; for adulterating soap and for making the so-called "lava" tips for gas jets; for electric insulation; for tailors', or French, chalk and for crayons; and for toilet powders.

The United States produces most of the world's supply, New York, Vermont, California, and North Carolina leading in output. Talc deposits are also worked in Canada, Germany, France, and Italy.

TAL'ENT. Used in the Greek, Hebrew, and other ancient civilizations, the talent was a unit of both weight and money. As a unit of weight the Greek talent was equal to about eighty-two pounds. This unit was subdivided into sixty *minae*, or 6,000 *drachmae*. As a unit of money, the talent contained about fifty-seven pounds of gold or silver. The Hebrew silver talent was worth approximately $1,850, that of the Greeks was valued at about $1,080. The Romans also used monetary units called the *great* and *little* talents, the former equal to about $480, the latter about $363. The talent both as a unit of weight and money varied considerably from country to country.

TALKING MACHINE. See PHONOGRAPH.

TALLAHASSEE, *tal a hass'ee,* FLA. Located about 165 miles west of Jacksonville and but twenty-five miles from the Gulf on the south, Tallahassee, capital of the state, is built on an elevation 216 feet above sea level, around the junction of the famous old Spanish Trail and the modern Dixie Highway. Set amidst the hilly surrounding country dotted with lakes, the city, with its broad streets shaded with magnolias and moss-hung oaks, is one of the beauty spots of the South. It is a modern trading and shipping center, served by rail and air lines and by excellent arterial highways.

Among the important buildings are the State Capitol, the governor's mansion, the Federal building, and the Supreme Court Library. Tallahassee is also the seat of the Florida State College for Women and the Florida Agricultural and Mechanical College for Negroes.

The city is unimportant industrially, the principal manufactures being tobacco, cottonseed oil, canned goods, lumber, and naval stores. It is, however, an important market for sugar cane, dairy products, tobacco, and cotton. Tallahassee became the capital in 1824, and was incorporated as a city in 1827. Its population is approximately 49,000.

TALLEYRAND-PERIGORD, *tah la rahN' pa re gor',* CHARLES MAURICE, Duc de, Prince of Benevento (1754-1838). Ranking among the most able statesmen of his time, Charles Talleyrand as French foreign minister guided his country through one of the most difficult periods in its history. Politically shrewd and unscrupulous, he used any means to attain his own ambitions and those of his country.

Born in Paris, Talleyrand was educated

CHARLES TALLEYRAND
France's shrewdest nineteenth-century diplomat.

for the priesthood. In 1775 he received an appointment as abbot of Saint Denis, and in 1788 became the Bishop of Autun. In the following year he was elected to the States-General. After serving on a committee to draft a new Constitution for France, he assisted in the framing of the Declaration of Rights and proposed the confiscation of all Church property by the state, a move which brought about his excommunication.

In 1790 he was elected president of the National Assembly. Two years later, while on a diplomatic mission in London, Talleyrand met the disfavor of the Robespierre government and was not permitted to return to France. He sailed for America, but in 1796 returned to France and a year later became foreign minister under the Directory. In this position, he remained until dismissed by Napoleon in 1808.

He immediately became an ally of Napoleon's enemies and was active in securing the emperor's abdication. After the Congress of Vienna, in which Talleyrand participated, he again became foreign minister, but he held office for only a short time and then retired. He again came into public life in 1830 as chief adviser to King Louis Philippe, and was made ambassador to England, where he secured the important Quadruple Alliance of 1834, the members being England, France, Portugal, and Spain.

TAL'LOW. Before the days of the kerosene lamp and the gas and electric light, tallow was used extensively in the molding of homemade candles. Today it is very little used in the home, although it does enter into the manufacture of a number of important products.

Tallow is the hard, white fat of cattle, sheep, or goats, and is obtained in its pure form by the process of rendering, in the same manner as lard is made from hog fat. It is made up of two solid fats, stearin and palmitin, and a liquid fat, olein. The heavy, brittle fatty tissue from the loins and kidneys of the animals is called *suet,* and is used in cooking meats and certain pastries.

Beef tallow enters into the manufacture of oleomargarine; sheep tallow is unfit for this purpose because it becomes rancid after a short time. Tallow is also used in making leather dressings, candles, soap, and tallow oil, the latter an ingredient of steam-cylinder oils. See TALLOW TREE.

TALLOW TREE. Introduced into America from China, tallow trees are now found from North Carolina to Florida and west to Louisiana. They belong to the spurge family. Tallow trees look somewhat like poplar trees, particularly as to the shape of their leaves. Unlike poplars, however, their fruits do not open and allow the seeds to be spread by the wind. The seeds are not fitted for such a means of transportation. Instead, they are covered by a white, waxy substance, which makes an interesting contrast with the red of the foliage in autumn. In China and Japan, the seeds are collected and the wax is made into candles or soap, or prepared for export.

In America, where the tree reaches a height of about fifty feet, it is grown largely for ornamental purposes. In Asia the wood is used in furniture, and it is claimed to have been used in the making of wooden type.

TAL'MUD, The. Extremely valuable, not only to the leaders of Judaism, but to scholars and historians who delve into the records of ancient people, is the Talmud, a book of Jewish laws. In it are contained all the laws governing religion, morals, conduct, and ethics of the ancient Jews, in addition to descriptions, discussions, arguments, anecdotes, and explanations of the life of the various times in which the book was written.

The Talmud is in two parts. The first, called the *Mishna,* meaning *instruction,* is written in pure Hebrew and contains laws regarding tithes and agriculture; regulations concerning feasts, festivals, and observance of the Sabbath; rules for marriage, oaths, and vows; criminal penalties; types of sacrifices, including a description of the Temple of Jerusalem; and various purifications. The second part, known as the *Gemara,* is written in Aramaic, and includes discussions of the *Mishna* by scholars. It also has a wealth of miscellaneous information compiled between the third and the sixth centuries.

TAMARACK, *tam'a rak.* See Larch.

TAM'ARIND. Grown for ornament and its fruit, the tamarind is native to tropical Africa and Asia. It is an evergreen, tropical in its temperature requirements, but will grow in regions of scanty rainfall if irrigation water is available. On rich soils the tree may grow to be seventy-five feet high. The tamarind belongs to the same family as the locusts. The leaves resemble those of the common locust.

The fruit is a pod four to seven inches long, resembling some of the bean pods. Generally from three to seven seeds are embedded in the pulp, which is soft and brown in color, and has a subacid taste. Upon the addition of sugar and water, a refreshing laxative drink is made from the juice. The fruit is used in cooking in India, and the juice in pickling fish.

TAM'ERLANE. See Timur.

TANAGER, *tan'a jur.* Many brilliantly colored birds of America are called tanagers. The family is a large one, containing over 300 species, but most of them are tropical, only four occurring in North America. Of these the *scarlet* tanager is perhaps the best known in the eastern half of the United States and Southern Canada during the breeding season. Like the *summer* tanager, it winters in South America. The male bird is about seven inches long, scarlet-red except for the wings and tail, which are black. The female and the male in winter plumage are colored dull yellow and green, the latter with black wings and tail.

THE SCARLET TANAGER
Though shy, he is a rollicking songster.

In the Southern states as far north as New Jersey, the summer tanager occurs. The male is rosy red all over, duller on wings and tail, but the female is olive-green and yellow. It resembles the scarlet tanager in habits, living mostly in woodlands and feeding on insects and wild fruit.

TANCRED, *tang'kred* (about 1078-1112). A Prince of Antioch who won fame and glory at the siege of Nicaea, the capture of Antioch, the fall of Jerusalem, and at Ascalon, Tancred was a renowned hero of the First Crusade to the Holy Land. He was later made the Prince of Galilee by Godfrey de Bouillon, and appears in Tasso's poem, *Jerusalem Delivered,* as the spirit of chivalry.

TANGANYIKA, *tahn gan ye'ka.* Located in a wild, rugged section of East Africa, Lake Tanganyika forms part of the boundary between Tanganyika Territory on the east and Northern Rhodesia and the Republic of the Congo on the west. It extends into the latter country a small distance. One of the world's largest and deepest lakes, it measures about 450 miles in length and varies in width from thirty to forty-five miles. Its area is about 12,700 square miles.

Lake Tanganyika is almost completely hemmed in by mountains, from which numerous rivers pour their waters into its deep basin. When the water is high, the lake overflows into the Lukuga, a branch of the Lualaba, or Upper Congo. Fresh-water fish and waterfowl are abundant, and there are crocodiles and hippopotamuses along the shores. Wherever there are level areas, sugar, corn, sweet potatoes, and rice are grown. The mountains are forested, and among other trees is the palm-oil tree.

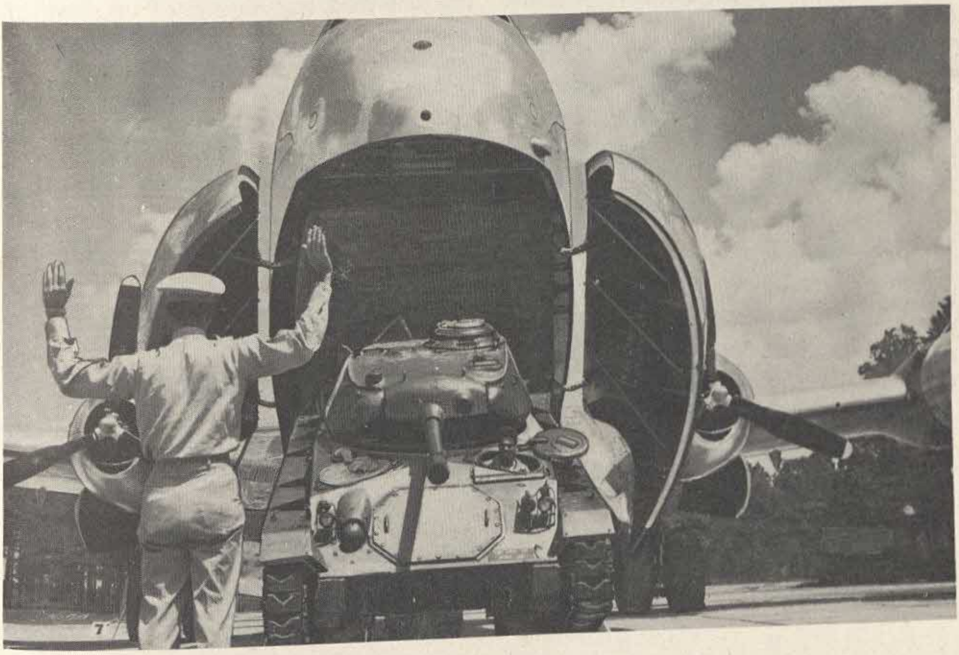
Lake Tanganyika was discovered in 1858 by Burton and Speke, and was later explored by Livingstone and Stanley. It is connected to Lake Nyasa by a 210-mile highway. Albertville, on its eastern shore, is joined with interior Congo by rail.

TANGERINE, *tan jur een'.* The small, somewhat flattened species of citrus fruit known as the tangerine is deeply colored, juicy, and delicious. Because of the ease with which the peel is removed, it is included in the group known as *kid-glove* oranges. Domestic forms of the tangerine have been developed from the Asiatic mandarin, and are an important crop in the Gulf states. See ORANGE.

TANK, ARMORED. First introduced by the British during World War I, the tank has since become one of the most formidable weapons of warfare. Tanks are heavily armored vehicles, driven by a gasoline or Diesel engine, and designed to operate over rough ground. They roll on endless cleated belts, called *caterpillar treads;* these treads support the weight of

STEEL CAVALRY RIDES THE AIRWAYS

Speedy light tanks can now be rushed to battle areas in giant cargo planes. *Acme Photo*



TANNHAUSER THREATENED WITH DEATH AT THE MINSTRELS' CONTEST
At a contest of the minnesingers, Tannhauser angers his rivals by his unconventional singing, and they threaten him with drawn swords. This scene is from Wagner's opera *Tannhauser*, which is based on an old legend of the mythical knight.

the tank on soft or uneven ground, while the cleats supply tremendous traction. Large numbers of these machines are indispensable to the modern mechanized army.

During World Wars I and II, tanks were used to lead and to protect infantry attackers and to destroy enemy positions, smashing barbed-wire entanglements, machine-gun "pillboxes," and other obstructions. Light tanks, faster and less heavily armed and armored than medium and heavy tanks, are often used for scouting purposes and are sometimes dropped by parachute. Heavy tanks, which may weigh over seventy tons, can grind most obstructions to bits. Specialized forms include the *tank destroyer,* a chassis carrying a heavy gun; the *flame-thrower tank*; and the *amphibious tank*, capable of fording rivers and making beach landings.

Armor plate covers the tank and its surmounting gun turret, which can be swung in any direction. Tanks carry guns of varying kinds and crews of as many as eight men, including drivers and gunners.

Traps and barriers, such as land studded with closely placed, partly buried concrete posts, are used to stop tanks, but most of these can be eluded or smashed. Therefore special shells, rockets, mines, and bombs are the chief defenses against tanks. After World War II the United States favored medium tanks and fast, light tanks with air-cooled engines.

TANNHAUSER, *tahn' hoi zur.* The hero of a Wagnerian opera, Tannhauser was a famous legendary knight of Germany. According to the story, he gained admission to the court of the goddess Venus in the hill called Venusberg, in the heart of the Thuringian Forest. There he remained until he heard the voice of the Virgin Mary calling him back to the world. Venus allowed him to leave, and the hero started on the long journey to Rome to ask the Pope's forgiveness. The Pope, however, declared that it was as impossible for him to forgive Tannhauser as it was for his staff to bud and bear green leaves. Tannhauser returned in sorrow to Venus, but, in the meantime, the Pope's staff had actually begun to sprout. This miracle was accepted as a sign from God that the knight should be forgiven. Messengers were sent to find him, but Tannhauser was never seen again.

Two of the beautiful melodies in Wagner's opera are *Hymn to the Evening Star* and *The Pilgrims' Chorus.* The opera was first produced in Dresden in 1845.

TAN′NIN, or TANNIC, *tan′ik,* **ACID.** A group of powdery, organic substances, tannins, or tannic acids, are obtained from the barks of such trees as the hemlock, alder, ash, oak, and sumac, and also from gallnuts. These powdered barks and nuts are combined with a mixture of alcohol, ether, and water, from which the various tannins are obtained by evaporation. Bitter in taste and very strongly astringent, tannins have many applications in industry, especially in tanning, dyeing, and in the manufacture of inks. Tannic acid has also been used as a medicine.

TAN′NING. See LEATHER.

TANSY, *tan′zi.* Formerly a very popular herb, tansy is now so little valued, in America at least, that the demand is largely supplied from plants growing wild by the wayside. When it is cultivated it must be watched to keep it from spreading. In England, tansy used to be made into cakes called *tansies,* and there is an old rhyme:

On Easter Sunday be the pudding seen
To which the Tansy lends her sober green.

By some persons, tansies were eaten in memory of the bitter herbs of the Jewish Passover; by others they were considered "very wholesome after the salt fish of Lent."

The plant is a perennial. The leaves are greatly divided, and the flowers, which come in midsummer in dense clusters, are yellow and small. Tansy tea was formerly used for household medicinal purposes.

TAOISM, *tou′ iz′m.* One of the great Chinese religious systems, Taoism originated in China in the sixth century B. C. Its principles were set forth by a wise man named Lao-tse, who lived at the same time as Confucius. Ancient Taoism, in general, was a code for the conduct of life, which, if followed, led the individual to happiness, peace, and contentment. The Chinese rank Lao-tse almost on a par with Confucius among their thinkers and philosophers, but Taoism as practiced today is a religion of superstition and magic rites. See CHINA.

TAP′ESTRY. The weaving of tapestry is one of the world's oldest arts. The exact origin is unknown, but tapestries dating back as early as the fifteenth century B. C. have been found in Egypt. Through the ages, these ornamental fabrics have been used as wall hangings and as furniture and window coverings in churches and palaces and homes of the wealthy, all over the civilized world. But the cost of genuine tapestry is far beyond the reach of the average home.

The term is used to designate two entirely different groups of fabrics. One is made by an expensive process of ancient origin. It involves the hand weaving of colored threads (called weft threads) through the undyed warp threads stretched upon a loom. The varying colors of the weft threads produce the desired pattern. The weaving is done with a combination bobbin and shuttle, for in true tapestry, needles are never used.

Tapestries of the second group, known as *curtain* tapestries, are but woven imitations of the first. They are made on a special loom with a double warp. The weaving is done by shuttle, and the design shows on only one side of the fabric. Although but imitations of genuine tapestry, even the curtain tapestries far outwear other materials when used as furniture coverings.

The Development of Tapestries. The art of tapestry weaving reached its height about the fifteenth century, centering principally in Arras, Tournai, Brussels, Bruges, Lille, and Valenciennes. Later the art spread to Paris where, in the seventeenth century, the Gobelin family created tapestries which became famous the world over.

Tapestry weaving was introduced into England about the middle of the sixteenth

SIXTEENTH-CENTURY "LEGEND OF NOTRE DAME DU SABLON"

A masterpiece of the tapestry-weaving art of Brussels. For more than three centuries, the Belgian metropolis dominated the tapestry industry; later, Paris and Warwickshire, England, employing Flemish weavers, produced many beautiful and unique specimens.

century; but it was not until 1619 that the first factory was established; weaving continued there for nearly a century after the style of the French. Near London, toward the end of the nineteenth century, a factory was established which still continues in operation.

The year 1892 saw the introduction of the work in New York City, where it remained until moved to Williamsbridge. Here, too, the art closely imitated the French.

Probably the world's most famous tapestry is the *Acts of the Apostles* series hanging in the Sistine Chapel in the Vatican at Rome; these creations marked the substitution of the Italian for the Flemish style, a trend that has since become widespread.

The famous Bayeux "tapestry" is not tapestry because it is embroidered, not woven. Many European museums have valuable collections of tapestries. The Metropolitan Museum of Art in New York City has one of the finest collections in America; it includes the *Burgundian Sacraments,* a fifteenth-century example.

TAPIOCA, *tap i o'kuh*. Roots of the cassava shrub furnish tapioca, a starchy food. The product appears in several forms—the so-called *pearl* and *minute* tapioca, and tapioca flour. The flour is sometimes used to replace wheat flour in bread, although it cannot be considered a good substitute because it contains less protein. It is also used for thickening, as arrowroot is.

The tapioca usually found in the kitchen consists chiefly of starch and water and is used as the basis for many puddings. The pearl tapioca is soaked in cold water for about an hour, then cooked in milk, water, or fruit juice. The minute tapioca is finer and does not require the preliminary soaking; hence its name. Tapioca is cooked until it is translucent; that is, until all of the starchy look has disappeared. It is usually necessary to cook it over water. The final product should be soft and clear.

TAPIR, *ta'pur.* One of the queer animals of South America, Sumatra, Borneo, and the Malay Peninsula is the tapir. The South American species is not found anywhere else. The animals are related to the horse and the rhinoceros, and in general appearance resemble pigs. They have small eyes, and the nose looks somewhat like a short elephant trunk. There are four toes on each of the front feet and three on each of the hind feet. The creatures spend their time in warm forests, sleeping or hiding by day, and at night going out for their food. They eat plant materials of many sorts. A South American tapir may reach a length of six feet and a height of three feet, and the Malayan tapirs are larger, some of them measuring eight feet in length.

Tapirs are hunted for their flesh, which is used as food; for their hides, which make excellent leather for harness; and to protect crops which they destroy.

SOUTH AMERICAN "ELEPHANT"

A peculiar resident of the densely forested eastern slopes of the Andes, the tapir is easily caught and seems to thrive in captivity.

TAR. Destructive distillation of wood, shale, coal, oil, or peat yields tar, a complex mixture of hydrocarbons. It is generally a black or dark-brown liquid, quite viscous, and has a distinctive odor. Wood tar, which collects below the kiln, is a dark, thick liquid, but wood tar obtained from wood distillation in retorts is much thinner. The redistillation of wood tar gives creosote, paraffin, and pitch.

Wood tar is used for preserving rope and felt. It is used extensively in the preparation of ointments and soaps, for the treatment of skin diseases, and for the preparation of medicine to be taken internally for coughs and bronchitis. One of the oldest uses of tar is in calking the seams of ships to make them watertight, and in treating ship gear to prevent injury by salt water. See COAL TAR; CREOSOTE.

TARANTULA, *ta ran'tu la.* This name is given to several hairy spiders found in Southwestern United States, South America, and Central America, but the true tarantula spider is a species first studied in the city of Taranto, Italy. Tarantulas are large, greedy spiders that attack their victims instead of capturing them in webs. Some tarantulas are capable of killing small birds. During the day the spiders remain in ground burrows lined with silken webs. Their bite is painful, but is not known to be definitely poisonous.

TARIFF, *tair'if.* Charges made by governments on goods entering or leaving a country are customs duties, or tariffs. They may be either export or import tariffs, although duties now are usually placed only on imports.

There are three general types of tariffs: one simply to obtain revenue for the government; another to protect home industries from foreign competition; and another, a retaliatory tariff, to answer unfair commercial treatment by other nations.

Those nations which levy tariffs for revenue only are said to practice free trade. For many years England was the outstanding example of a free-trade nation. England adopted this policy primarily because she possessed few natural resources and had to import raw materials, manufacture them into finished goods, and then export them. With the gradual acquisition of colonies and the development of their natural resources, England began to drift away from free trade, and now is classed with the nations which have protective tariffs.

A protective tariff is desirable for a new nation which has abundant resources and wishes to develop its own manufacturing interests. A new industry cannot compete at the outset with well-established industries in other countries, but a tariff on the goods imported can equalize the selling price of the domestic and foreign goods. As a result, people will be inclined to support the home industry. Protective tariffs are also used to keep out cheaper foreign goods produced with low-wage labor, in order to maintain a higher wage scale at home.

There are numerous arguments advanced against protective tariffs. Foremost among them are that such tariffs tend to break down world trade and international good will; smaller nations are unable to trade their goods in order to buy goods they need; and those best able to produce at the cheapest cost to the consumer are restricted.

Retaliatory tariffs are no longer in vogue, although certain European countries have raised their tariffs on American goods because of the high American tariffs. Reciprocity trade agreements are becoming more frequent, however. In these agreements one nation agrees to admit certain articles at lower than the established tariff rate provided the other nation agrees to admit certain other goods on the same basis.

The practice of levying tariffs dates back to ancient days. Egypt and Babylonia had tariff systems, as did the later Romans and Greeks and nations of the Middle Ages.

United States Tariffs. Before the adoption of the Constitution, some states had tariffs; but there was no national policy. After the formation of the Union, Congress was given the sole right to levy tariffs (Constitution, Article I, Sec. 10).

The first tariff act was passed in 1789, primarily for revenue but also containing a provision for the "encouragement and protection of manufactures." From that time on, tariffs have been a national issue.

In 1816 and again in 1824, bills were passed increasing the rates. Clay and other "loose constructionists" favored protective tariffs, but the "strict constructionists" opposed them.

The "tariff of abominations," passed in 1828, was protective in character and was condemned by the Southern states. In 1832 the "abominations" were removed, but the South was still incensed. So in 1833 a compromise tariff was passed to satisfy South Carolina and to get the state to repeal its nullification acts. Among other important tariff acts between that time and the close of the Civil War were the Walker and Morrill acts, imposing high rates.

After the Civil War, the tariff policy of the United States varied with different administrations. Generally speaking, the Republicans passed bills levying higher tariffs than those sponsored by the Democrats. Under Franklin D. Roosevelt, Congress in 1934 gave the President power to adjust tariffs by means of reciprocal trade pacts. This authority was renewed at later sessions of Congress.

At various times, boards have been appointed to assemble facts on tariff questions. A permanent Tariff Commission was created in 1916. See FREE TRADE.

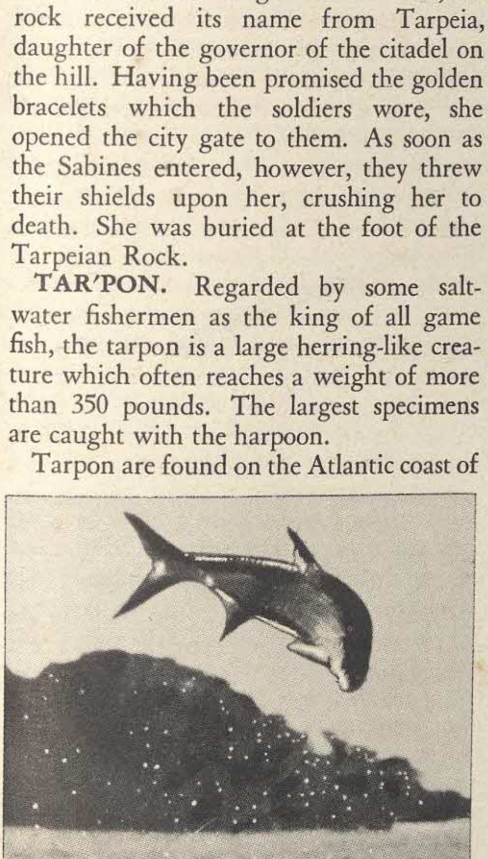
TARKINGTON, *tahr'king tun,* NEWTON BOOTH (1869-1946). Few other American novelists have met the wholehearted response accorded Booth Tarkington for his first book, *The Gentleman from Indiana,* published in 1899. Tarkington was born in Indiana and was educated at Purdue and Princeton universities. A few of his novels, including *Seventeen, Penrod,* and *Monsieur Beaucaire,* were successfully dramatized; the last named was also produced as an operetta.

The Magnificent Ambersons was published in 1918 and was awarded the Pulitzer prize. *Alice Adams* won the Pulitzer prize for 1922. In the following years, Tarkington produced a veritable parade of best sellers, including *Gentle Julia, The Midlander, The Plutocrat, Presenting Lily Mars,* and *Mary's Neck*. Among Tarkington's best plays, some of which were written in collaboration, are *Cameo Kirby, Clarence, Mister Antonio, The Man from Home,* and *The Intimate Strangers.*

TARPEIAN, *tahr pe'yan,* **ROCK.** Jutting out from the Capitoline Hill at Rome, the Tarpeian Rock is a high, steep cliff from which criminals were thrown in ancient times. According to the tradition, the rock received its name from Tarpeia, daughter of the governor of the citadel on the hill. Having been promised the golden bracelets which the soldiers wore, she opened the city gate to them. As soon as the Sabines entered, however, they threw their shields upon her, crushing her to death. She was buried at the foot of the Tarpeian Rock.

TAR'PON. Regarded by some salt-water fishermen as the king of all game fish, the tarpon is a large herring-like creature which often reaches a weight of more than 350 pounds. The largest specimens are caught with the harpoon.

Tarpon are found on the Atlantic coast of the Americas from Brazil to Long Island, and in the Gulf of Mexico. They move from place to place during the year, probably breeding around Puerto Rico. It is during the winter months that they are most common on the Florida coast. They feed upon small fish which they sometimes follow up rivers for considerable distances.



THE FIGHTING "SILVER KING"
A tarpon's leap to dislodge the angler's hook.

Tarpon have unusually large silvery scales, which add to their general beauty. These scales, which are often three inches across, are sold as curiosities and as trinkets.

TARQUIN'IUS, Lucius, surnamed Superbus, *The Proud.* Ruler of Rome from 534 to 510 B.C., Lucius Tarquinius was the son of Lucius Tarquinius Priscus. He was the last of the traditional Roman kings. Tyrannical and cruel, Tarquinius murdered his father-in-law, Servius Tullius, seized his throne, immediately deprived the common people of their privileges, and abolished many of the democratic reforms of his predecessor. Although he strengthened Rome's power abroad through several wars, these struggles were financed by means of unbearable taxes. The king's cruelty finally brought about a revolt in 510 B. C., and he was driven from the throne, a republic being then founded. Macaulay's famous poem, *Horatius at the Bridge,* recounts one of the attempts to restore the imperial power of the Tarquins.

TAR'TAN. In weaving, the tartan pattern consists of stripes of different colors crossing one another at right angles so as to form a definite pattern of plaids or checks. The cloth so woven is also called tartan, and may be wool, cotton, or other fabric. Clan tartan was used in the distinctive dress of the Scottish Highlanders and appeared in the shawl worn over the shoulders and in the kilt. Each clan had its particular tartan, always showing a certain arrangement of broad and narrow colored stripes.

TARTAR'IC ACID. Soluble in water and alcohol, tartaric acid is an organic acid, appearing ordinarily as large crystals. It occurs abundantly in the vegetable and animal kingdoms, both free and combined.

It is found as the acid potassium salt in grapes. When grape juice is fermented, crude acid potassium tartrate, called *argol,* is precipitated. When purified, this is called *cream of tartar.* It is from argol that the commercial tartaric acid is obtained, by treatment with sulphuric acid and crystallization. It is used in the manufacture of baking powders and dyestuffs, in photography, (owing to its peculiar reaction to light), in pharmacy, and in calico printing.

TASMANIAN WOLF. Formerly a serious menace to the sheep-raising industry of Tasmania was the fierce Tasmanian wolf, a night raider that inhabits the mountains of the island. It generally grows to a length of about three and one-half feet, and has a heavy coat of grayish-brown fur, with dark cross stripes extending from shoulders to tail. Its peculiar markings have earned it the nickname of *zebra wolf.* The head of the beast is remarkably like that of a dog, and its tail is long and tapering. Like the kangaroo, the Tasmanian wolf carries its young in a pouch. It belongs to the order of marsupials (see Marsupialia).

TAS'SO, Torquato (1544-1595). Tasso's rank as one of the foremost Italian poets rests chiefly on his fine dramatic poems and his two great epics, *Rinaldo* and *Jerusalem Delivered* (his masterpiece). Born at Sorrento, Tasso studied under Jesuits at Naples, and later continued his education under the guidance of his father.

At the age of sixteen he went to Padua to study law, and while there produced *Rinaldo,* a remarkable accomplishment for a youth not yet eighteen. After spending some years in the service of Cardinal Luigi d'Este, Tasso received an appointment to the court of the Duke of Ferrara, where he published his pastoral drama *Aminta* in 1573 and completed *Jerusalem Delivered* in 1575. Shortly afterward, Tasso became insane; and in 1579 the duke confined him in a madhouse, where he remained for seven years. Eventually he was released at the request of Prince Vincenzo Gonzaga. Tasso retired for a time to Mantua, where he wrote a tragedy called *Torrismondo.* In 1594 the Pope invited him to Rome to be crowned poet laureate. But the poet was ill when he reached Rome, and the ceremony was postponed. Tasso died without receiving the honor, but his fame as a poet is imperishable.

TASTE. Our sense of taste begins to function almost as soon as we put food into the mouth. On the upper side of the tongue and upper back parts of the mouth are tiny elevations called *taste buds,* which serve as the end organs of a network of nerve filaments. These filaments connect with certain nerves leading to the taste centers in the brain. When the taste centers in the mouth are stimulated, the sensation is carried to the brain, which interprets the message. That is, we cannot recognize the sense of taste until the process is completed by the brain centers. A substance must be in solution before it can stimulate the taste centers.

There are four sensations of taste which we can distinctly recognize—sweet, salty, bitter, and sour. All other taste sensations are but combinations of these. Taste is bound up with two other senses—those of sight and smell. Numerous experiments, in which the sight and smell are temporarily shut off, show that most people have difficulty in identifying substances by taste.

TAU'RUS. Consisting of about 140 prominent stars, Taurus (the Bull) is one of the most interesting constellations in the heavens. North of the equator, it appears directly overhead in midwinter. The grouping of the stars suggests a giant bull whose face is formed by a triangular collection of stars called the *Hyades.* Two bright stars above this group are the horns· seven others, called the *Pleiades,* mark the animal's shoulder. The largest star in the constellation is Aldebaran, a brilliant red star of the first magnitude. Taurus is also the name of the second sign of the zodiac, into which the sun passes about April 20.

TAX. It costs money to run a government; and a government, whether national or local, obtains money largely through taxes. Taxes are levied upon various kinds of property or on income and fall into two general classifications, direct and indirect. A direct tax is one which cannot be easily passed on to someone else by the person who first pays it; examples are poll taxes, general-property taxes, and income and inheritance taxes. A tax collected from one person who, in turn, collects it from someone else is an indirect tax. Sales taxes, customs duties, tobacco taxes, and other manufacturing duties fall into this classification. For example, a grocery store is charged a sales tax on food sold; the grocer, in turn, may add the tax to the selling price of the food or, in some states, may charge the tax directly to his customer.

Taxes may be divided into two other groups, tangible and intangible. Tangible taxes are those placed on real property, the value of which is in itself, such as land, furniture, and jewels. Taxes on the sale of goods, on stocks and bonds, and on incomes fall into the intangible class; they are based on property or actions which represent values and earning capacity, and not on permanent, real goods.

Principles of Taxation. The famous Scottish economist, Adam Smith, laid down four fundamental principles of taxation, which have long been generally accepted in theory. These principles are: (1) every person should contribute to the upkeep of the government as nearly as possible according to his ability to pay; (2) the tax should be certain, not unfair and arbitrary; (3) every tax should be levied at the time and in the manner most convenient to the people; (4) the system of taxation should be such that the cost of collection is not great.

National and Local Taxation. The Federal government derives its revenue largely from intangible taxes: customs duties, tariffs, inheritance taxes, income taxes, and "nuisance" taxes (those on amusements, checks, legal papers, luxuries, and so on).

The state, county, township, school district, and other lesser governing units raise their money for expenses largely through the general-property tax, that is, on real estate and personal property. Almost all states today, however, have inheritance, income, and sales taxes to supplement their revenue and to reduce the burden placed on the general-property owner. Within any tax district the taxes levied are supposed to be uniform in rate and to be based on a just assessment arrived at by the assessor of the taxing district.

Taxes for the state are usually decided upon by the legislature, which submits its demands to the county. The county decides on its requirements, and these requirements, combined with those of the states, are turned over to the township. The township adds to the levy the needs of the local government, school districts, paving and sewerage districts, and so on. On the township treasurer rests the burden of collecting the combined taxes. If the individual lives in an incorporated village or city, the city collector has charge of tax collections. The foregoing is the general method by which taxes are collected, although the system is much more complicated than that described.

Tax Sales. When a property owner fails to pay his taxes within the time specified by law, the tax collector has the right to offer the property for sale at public auction. The sale is advertised beforehand; and the property goes to the highest bidder, who generally agrees to pay the back taxes and cost of the sale. Within a given time, the original owner has the right to redeem his property. The new title does not become valid until this time has expired.

For additional information, consult the following articles:

Excise Tax
Income Tax
Inheritance Tax
Internal Revenue
Smith, Adam
Tariff

TAXIDERMY, *tak'si dur mi.* Animals which seem ready to spring from their glass cases are the highest expression of the taxidermist's art. Taxidermy, which is a difficult and highly technical art, requiring

A TRIBUTE TO TAXIDERMY
Seemingly alive is this Rocky Mountain goat.

an extensive knowledge of many arts and sciences, is a method of preparing and mounting the skins of dead mammals, birds, fish, and reptiles to make them look like live specimens. In general, these specimens are for use in the exhibits of great museums of natural history.

After the specimen has been secured, the first step in the process is removing the skin of the dead animal. This work is done with exceptional care, and every part of the body covering, even to the ends of the toes, is removed. The covering is then treated with a preservative. While the skin is being suitably preserved, the form or body upon which the skin is to be placed is made. The body is usually made of papier-mâché, plaster, or clay, shaped over a wire framework. Accurate drawings of the specimen are used as a guide, and the form is delicately worked over until it has the exact shape of the body of the original specimen.

After the model is finished, the skin is carefully stretched and adjusted to fit the form, and artificial eyes are inserted. The finished specimen is then mounted in an exhibit, which is generally a scene from the animal's native home. These amazingly lifelike exhibits require extensive research on such natural objects as trees, grasses, and stones, which are then painstakingly reproduced. Placed in this setting, the animal is seen as though in its native haunts.

TAY'LOR, Zachary (1784-1850). As a tribute to his military achievements, rather than to his executive ability, Zachary Taylor was elected the twelfth President of the United States. By the close of the Mexican War, "Old Rough and Ready," as he was popularly known, was a national hero and easily defeated his opponents in the Presidential campaign of 1848. Taylor had never before held a political office of any kind. But he fully realized his shortcomings and proceeded to do the wisest thing under the circumstances—he appointed a good Cabinet. His well-laid plans, however, came to nought by his untimely death from typhoid fever, on July 9, 1850, in the second year of his administration.

Early Life. Zachary Taylor was the son of Richard Taylor, an officer in the Revolutionary War. Shortly after his birth in Orange County, Va., Zachary's family moved to a Kentucky settlement near the present city of Louisville. He received but little schooling. In 1808 he was commissioned first lieutenant in the seventh infantry and started his long military career.

During the War of 1812, his brilliant defense of Fort Harrison won for him the rank of major. After the war he proceeded in campaigns against the Indians. In 1832 he was made a colonel and took part in the Black Hawk War. After defeating the Seminoles at Okeechobee (1836), Taylor was given the rank of brigadier general and put in charge of all troops in what was then the southwestern division of the army. In 1845 he was transferred to Texas, when possibility of war with Mexico loomed in that section of the country. His outstanding work in this war is treated under the article Mexican War.

President Zachary Taylor. "Old Rough and Ready" was the Whig candidate for President in 1848 and easily won the campaign. Although he was sixty-five years old when he assumed office, he undertook to study seriously, for the first time in his life, the theory of American politics.

The slavery controversy was at its height. Almost all the questions before Congress involved slavery, and in his short administration Taylor adopted a determined, clear-headed manner of getting things done. He urged California to enter the Union at once as a state and to decide for itself whether to be slave or free territory. At the same time he warned Texas not to extend its slave territory by seizing more of Mexico. In Congress, Clay and Webster were attempting to save the Union by a compromise with Calhoun of the South. Taylor was impartial but discouraging to his Southern supporters. However, his successor, Millard Fillmore, favored the Compromise of 1850 and signed the bill after Taylor's death. President Taylor's Secretary of State, John M. Clayton, negotiated the Clayton-Bulwer Treaty with Great Britain in 1850.

ZACHARY TAYLOR
Popularly called "Old Rough and Ready," Taylor was swept into the Presidential chair on a tide of nation-wide popularity rising from his military exploits in the Mexican War.

Taylor's family, it is interesting to note, was sympathetic toward the South. His son, Richard, became a general in the Confederate army; and his daughter, Sarah, married Jefferson Davis, later President of the Confederacy. See CLAYTON-BULWER TREATY; FILLMORE, MILLARD; POLITICAL PARTIES IN THE UNITED STATES.

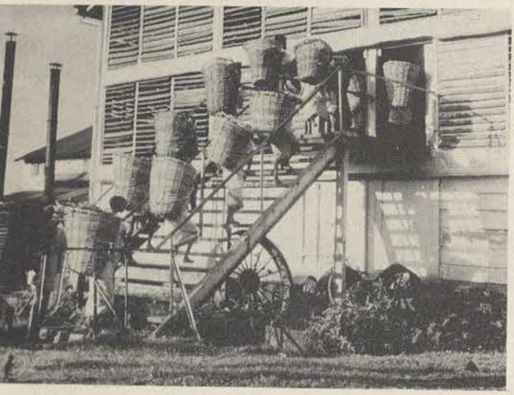
TCHAIKOVSKY, *chy kawf' ske,* PETER ILYITCH. See TSCHAIKOVSKY, PETER ILYITCH.

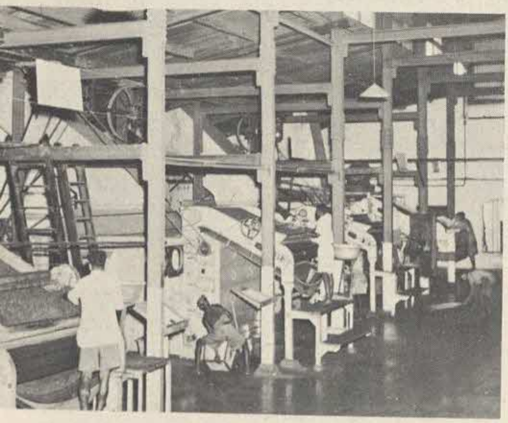
TEA. Steaming, freshly brewed tea, when properly prepared, is a delightful and refreshing beverage. It is a product of great commercial importance, and its cultivation is almost solely responsible for the modern development of some territories in the Far East. Tea is prepared from the leaves of the tea plant, an Oriental evergreen tree. This tree, which is cultivated as a low shrub from three to five feet high, grows to a height of thirty feet in a natural state. The dark-green leaves grow to a length of three or four inches, and the tree bears cream-colored blossoms, which resemble small roses.

In the early development of the Orient by European powers, tea was a fairly important factor. When the English and Dutch sailors took back tea from Japan and China in the middle of the seventeenth century, tea became very popular. A thriving trade sprang up, carried on through the great commercial companies already established in the East. This valued commodity was influential in increasing shipping, but it also had a considerable effect on the expansion of British and Dutch influence in the East during the seventeenth and eighteenth centuries, since the trading companies gradually extended their activities to include the administration of the region in which they were located. Upon this foundation, European powers later took absolute control of these areas. In the nineteenth century, tea was the basis for the great commercial development of Ceylon (British) and the East Indies (Dutch).

Cultivation and Preparation. For raising tea plants, an annual rainfall of from 60 to 200 inches is necessary. Thus the bulk of the world's tea is produced in the rainy, semitropical regions of India, Ceylon, Indonesia, China, Japan, and Indo-China.

Tea Council





HOW A CUP OF TEA BEGINS

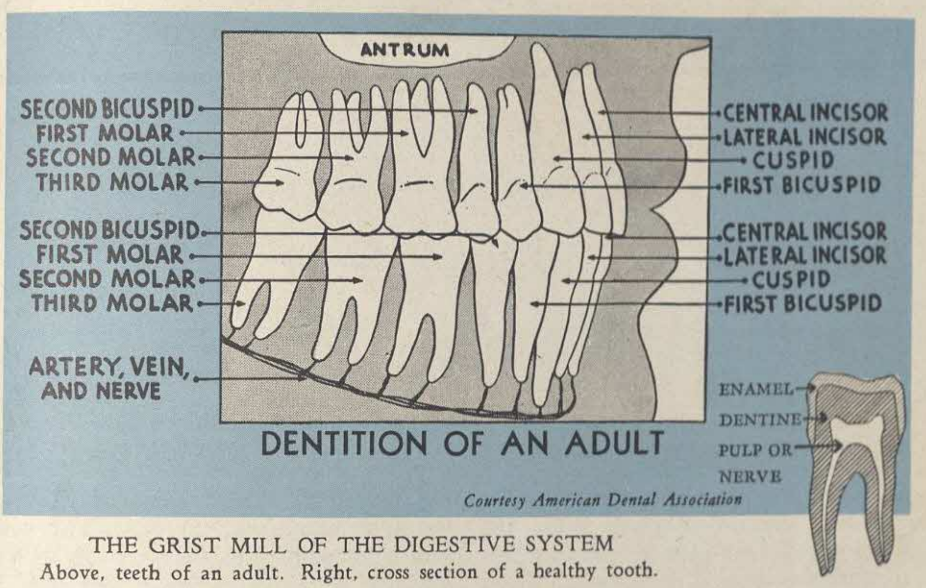
Tea plants, top left, are specially cultivated to produce seeds. The seeds are then carefully planted in porous soil, above. Tea leaves are picked by hand and carried in baskets to the withering shed, left, where they are spread out on racks to dry, then rolled and fermented under a damp cloth. Firing tea leaves, below left, is a process that heats the fermented and damp leaves to a high temperature. This gives the leaves the familiar black appearance of tea.

India, producing more than 726,000,000 pounds of tea per year, leads the world in the export of tea. Tea plants are grown from seeds which are started in nursery beds and which are later transplanted to the fields. The plants produce marketable leaves in three years, and become more and more profitable until, after about ten years, they reach full maturity. With care, they will continue to yield for fifty years.

The leaves are gathered many times a year, according to the rapidity of growth of new leaves. The first and second pickings provide the finest leaves; the last crop is the poorest. Satisfactory machines for tea picking have not as yet been developed, and most of the picking is still done by hand.

There are numerous varieties of tea, but all fall into two general classes, *black* and *green*. These two classes differ only in the method of preparation. Black tea leaves are "fermented"; green tea leaves, only partially so. In making black teas, the leaves are first withered by sunlight or artificial heat, after which they are rolled to remove any remaining moisture. Unrolled, the leaves are fermented by being placed on racks, covered with wet cloths. The final step is firing, a drying process carried on at a temperature of about 200° F. Green tea is prepared by steaming the leaves, which then go directly from the unrolling machine to the drier.

Tea, the national drink of Japan and China, is used in enormous quantities all over the world, particularly in Canada, England, and the United States.



Courtesy American Dental Association

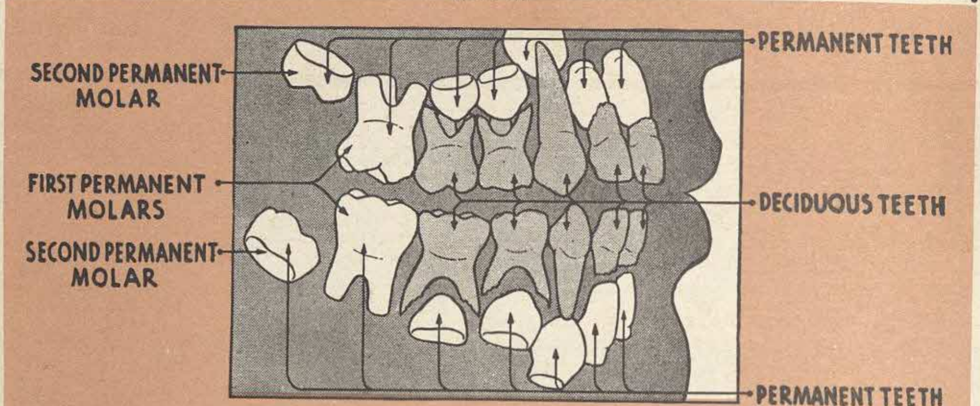
THE GRIST MILL OF THE DIGESTIVE SYSTEM
Above, teeth of an adult. Right, cross section of a healthy tooth.

TEAK, *teek.* Valued for its hard and durable wood, the teak tree, a deciduous member of the verbena family, is found in India, the Malay Peninsula, and the adjoining tropical islands. The tree, often growing to a height of 200 feet, bears huge leaves which yield a purple dye. The brownish-streaked wood takes a high polish and contains an oil which renders it waterproof and resistant to the attacks of termites. It is used in the manufacture of furniture and in shipbuilding.

TECUM'SEH, or TECUM'THA (1768-1813). Under the leadership of Tecumseh, a famous Shawnee chief born near the present city of Springfield, Ohio, the Indians of the South, Midwest, and Northwest banded together in a great federation. Their purpose was to prevent occupation of their lands by the whites. These lands, Tecumseh maintained, were common property of all the Indians, and therefore could not be sold by any single tribe. In a fight near Tippecanoe, Tecumseh's warriors were defeated by General Harrison in 1811, the chief himself being absent. Tecumseh immediately joined the British in Canada, aiding them against the Americans in the War of 1812. He was killed in the Battle of the Thames River.

TEETH. In the preparation of food for digestion, the teeth have a very important part. Thirty-two in number in the adult, the teeth are hard structures embedded in bony sockets in the upper and lower jaws. They grow from the mucous membranes of the gums, rather than from the bones, as might be supposed. Each tooth is composed of three parts—*pulp,* which is the soft center portion containing blood vessels and nerves; *dentine,* a hard, bony substance made up of lime and phosphate compounds, which comprises the greater part of the tooth; and *enamel,* a very hard, pearly-colored material which covers the entire visible part of the tooth. The visible portion of the tooth is called the *crown;* the part covered by the gums, the *neck;* and the part embedded in the jawbone, the *root.* The outer covering of the root is the *cement,* a bony substance which holds the tooth in place.

In man and the higher animals, two sets of teeth are developed—the *temporary, deciduous,* or *milk* teeth, and the *permanent* teeth. In man, the temporary set consists of twenty teeth, while in the permanent set there are thirty-two, sixteen in the upper jaw and sixteen in the lower jaw. In the adult, the four teeth at the front,



Courtesy American Dental Association

NORMAL TOOTH ARRANGEMENT OF A SIX-YEAR-OLD CHILD

called *incisors,* have a chisel-shaped crown especially adapted to biting food. On either side of these teeth is a single, sharp-crowned *canine* tooth, particularly adapted to tearing food. Canines are prominently developed in most wild animals.

The next two teeth are the *bicuspids,* marked by flat crowns used for grinding food. Following these are the *molars,* three on each side. These latter teeth are very strong, and their broad, flat surfaces are used for crushing food. The last molar is commonly called the "wisdom tooth," since it arrives between the seventeenth and twenty-fifth years. The teeth in the upper and lower jaws correspond.

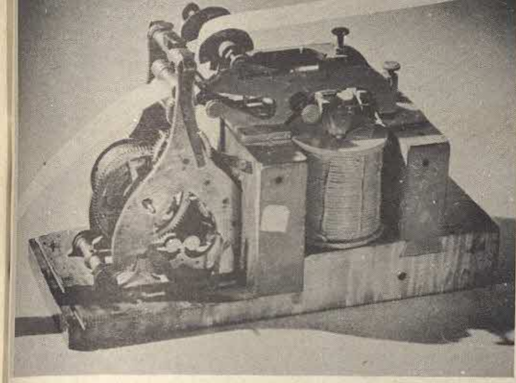
Good teeth, properly cared for, are essential to a person's health. The entrance of germs through cracks in the enamel decays the dentine, exposes the nerve, and causes toothache. Decay also results from food lodged between the teeth. Proper cleaning of the teeth and regular visits to the dentist will help prevent most tooth decay and will aid in avoiding serious body infections. See DENTISTRY.

TELAUTOGRAPH, *tel aw'toh graf,* the transmission of handwriting by electricity. The system consists of a transmitter, receiver, and a pair of wires joining the two stations. The transmitter has a metal pencil, or *stylus,* with which the message is "written" on a metal plate. Two small cords are attached near the tip of the stylus which regulate the amount of current flowing as the stylus moves over the plate. This current is transmitted to the receivers, where sensitive apparatus moves a pen over a sheet of paper, instantaneously and automatically duplicating the message. The telautograph, patented by Elisha Gray in 1888, is used in banks, brokerage houses, and other businesses for the quick transfer of signature *facsimiles* and messages.

TELEGRAPH, a method of sending messages by electrical impulses. The first message "What Hath God Wrought?" was sent by Professor Samuel F. B. Morse on May 24, 1844, from Washington, D.C., to Baltimore, Md. These four words opened a new means of communication. The telegraph links nations together and enables men to communicate with one another accurately and swiftly over long distances.

The Electromagnetic Telegraph. The simplest form of telegraph system consists of four parts—a battery or other source of power, a wire for carrying the current from station to station, a transmitter, and a receiving apparatus. Generators furnish most of the electrical energy.

The *key* on the transmitter makes and breaks the circuit and creates a series of dots and dashes in the distant receiving apparatus. The receiver consists of a *sounder,* made up of an electromagnet, above which is fastened an *armature.* The armature is a piece of iron attached to a brass bar which



FIRST RECORDER AND ITS INVENTOR

The original telegraph recorder, above, sent a short message only a short distance in 1844. Before long, however, the clicking of telegraphers' keys became a familiar sound, flashing messages all over the world. The first telegraph line used by inventor Samuel F. B. Morse, right, ran between Washington, D.C., and Baltimore, Md. It was financed by a congressional appropriation.

Western Union Telegraph Co.

is pivoted to allow vertical motion of the armature. When no current is passing through the magnet coils, the armature and bar are held by a spring.

The current must be strong enough to overcome the force of the spring. The clicking noise of the bar against the set screws, which limit the motion, is amplified by mounting the sounder on a thin board. Another piece of apparatus in the receiving equipment is the *relay,* similar to a sounder. The relay makes and breaks the circuit to the sounder, which is energized by local power. The line power operates the highly sensitive relay and this, in turn passes the signals to the locally energized sounder, giving a loud, clear series of dots and dashes.

When the key is pressed at one station, the circuit is closed, and the current travels through the wire into the relay of the receiver. This in turn closes the sounder circuit, creating a sharp, audible click. There is another click when the key is released as the spring returns the sounder armature to its former position. The dots and dashes are the time intervals between up-and-down clicks.

Telegraphic Improvements. J.B. Stearns made the first great improvement in the telegraph in 1872 by devising *duplex* telegraphy, a system whereby two messages could be sent over the same wire at the same time. Thomas Edison, two years later, worked out a system for sending four messages at once. A later system, *multiplex* telegraphy, allows many telegraph or telephone messages to be sent at the same time.

Other improvements include *rapid* telegraphy, which punches the dots and dashes on paper tape to be transcribed later; and the *stock ticker* and *teletype*. Stock tickers show immediate quotations of the exchange to brokers and investors all over the country. The teletype is widely used by newspapers, bringing them press-association reports from all over the world. Transoceanic cables transmit news, photographs, and business transactions. Many government dispatches are also handled by cables. Radio telegraph and radio telephone, however, have become serious competitors. They are widely used on ships, and in trains and automobiles.

Consult the following articles for additional information:

Cable, Submarine
Edison, Thomas A.
Electromagnet
Morse, Samuel F. B.
Telautograph
Telephone

TELEGRAPH, Wireless. See Electricity; Marconi, Guglielmo; Radio; Telegraph.

WIRING THE WORLD FOR SOUND

When Alexander Graham Bell demonstrated his telephone, a magic wire carrying sound, he made the first step in uniting the peoples of the world through rapid communications.

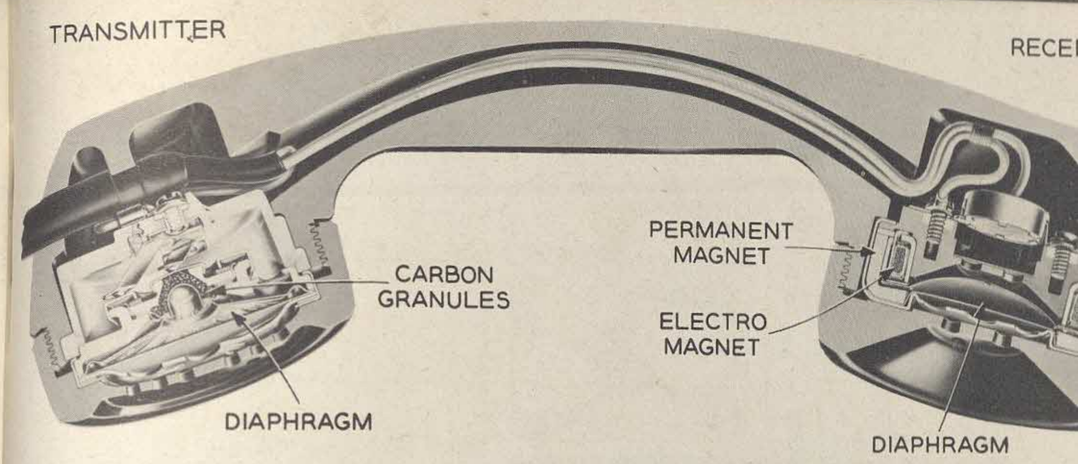
John Hancock Mutual Life Insurance Company

TELEPHONE, *tel' e fone*. In homes, on the farms, and in business establishments, the telephone plays such a vital part that it seems almost indispensable. With it, men and women communicate with one another simply and quickly. It conveys not only the voice but also laughter, joy and sadness, and emotional inflections of the voice. Through its magic wires the peoples of the world, separated by vast oceans and continents, are united through a world of communications. Business negotiations are carried on, friendly contacts are made, and, in general, the work of the world is aided materially.

How the Telephone Works. The word *telephone* means *to talk far off*. Actually, the voice does not travel from speaker to listener. It is an electric current that is transmitted through the wire, and this current reproduces in the receiver the sounds spoken into the transmitter.

The first successful telephone was invented by Alexander Graham Bell. The instrument was first demonstrated to the public at the Philadelphia Centennial Exposition in 1876. Today, there are almost 134,000,000 telephones in the world. Seventy-four million are in the United States; slightly over five million in Canada.

In 1960 the first telephone call via a man-made satellite was made by bouncing microwave radio signals off the Echo balloon orbiting 1,000 miles above the earth. However, conventional telephones use a line, a transmitter, a receiver, and a source of electric power. The transmitter consists of a plastic mouthpiece, in back of which is a thin metal diaphragm. Attached to this is a receptacle filled with tiny grains of carbon. This receptacle is made of a ceramic insulating material which holds the carbon granules and two electrodes which contact the granules. One of the electrodes is attached to the diaphragm and protrudes into the carbon. This electrode moves back and forth with the diaphragm in response to the impact of sound waves. The other electrode is stationary and on the other side of the carbon.



Bell Telephone Laboratories

CROSS-SECTION OF A MODERN HAND TELEPHONE

When a person speaks into the telephone, the diaphragm of the phone vibrates in accordance with the sound waves. These vibrations create a variety of heavy and light pressures on the carbon granules. The heavier the pressure, the stronger the current between the two electrodes. Such changes in current strength change the direct current in the microphone into pulsating direct current. In the primary of a transformer, the pulsations induce alternating-current voltages in the secondary, which is connected to the line.

The operation of the telephone receiver depends primarily on the use of magnets. One of the latest models makes use of a permanent magnet and an electromagnet. The alternating current flowing through the electromagnet alternately aids and opposes the magnetic field of the permanent magnet. Over the magnets is mounted a soft-iron disc which responds to the vibrations of current flowing into the electromagnet. The vibrations correspond with those created at the transmitter by the speaker's voice, thus reproducing the voice and its accents and inflections in the receiver held by the listener.

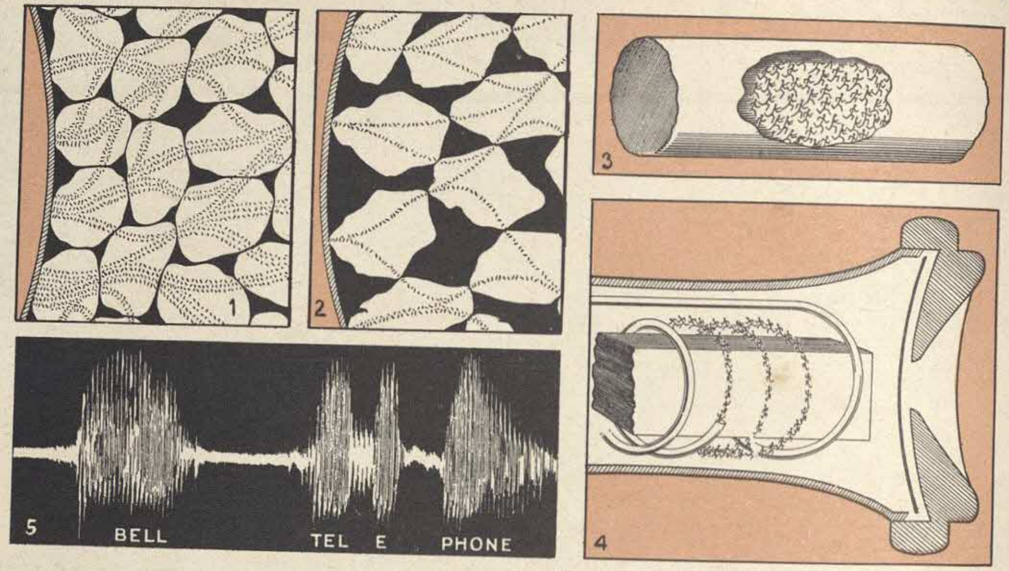
All the telephone lines of a city, district, or rural area are connected in an exchange office where switchboards enable the operators to connect the subscribers with any other telephone in the local system. Trunk lines reach out to neighboring cities, and, in large cities, to neighboring exchanges.

Developments. The dial system permits a person to reach a desired number without the aid of an operator. He turns a finger dial on the telephone, and the call is put through by complicated switching mechanisms. Openings in the dial are placed above or beside the letters and numbers on the plate below the dial. The caller spins the dial around to a stop for each exchange letter and number—the dial each time returning to its original position before dialing. Push-button dialing is accomplished by the substitution of numbered and lettered buttons for the turning dial. Some sets have a small speaker instead of the

BOUNCING A CALL OFF A BALL

The first telephone call through space was made in 1960 from California to New Jersey by bouncing microwave radio signals off the Echo satellite balloon.

Bell Telephone System



Courtesy American Telephone and Telegraph Co.

THE MYSTERIOUS INNER WORKINGS OF THE TELEPHONE OF TODAY

(1) Enlarged fifty times is this view of the carbon grains in the transmitter. When we speak into the instrument, the diaphragm bends inward, forcing the grains together and allowing more electrons to flow. (2) Same, when not in use. (3) How electrons, if animated, rush through a wire. (4) Electron flow around magnet. (5) Photograph of electric current.

usual mouthpiece to free the hands of the caller or person called. These sets are also used for conference calls. Special sets have extra speakers for intercommunication between rooms.

Another development permits telephone and telegraph messages to be sent over the same wires without interfering with each other. Transoceanic communication is accomplished by radio telephone and by submarine cables. Telephoning around the world by cable was expected by 1964. See Radio; Telegraph.

Special equipment also permits a telephone message to be scrambled so that anyone overhearing it would not be able to understand the conversation unless it passed through a decoding mechanism.

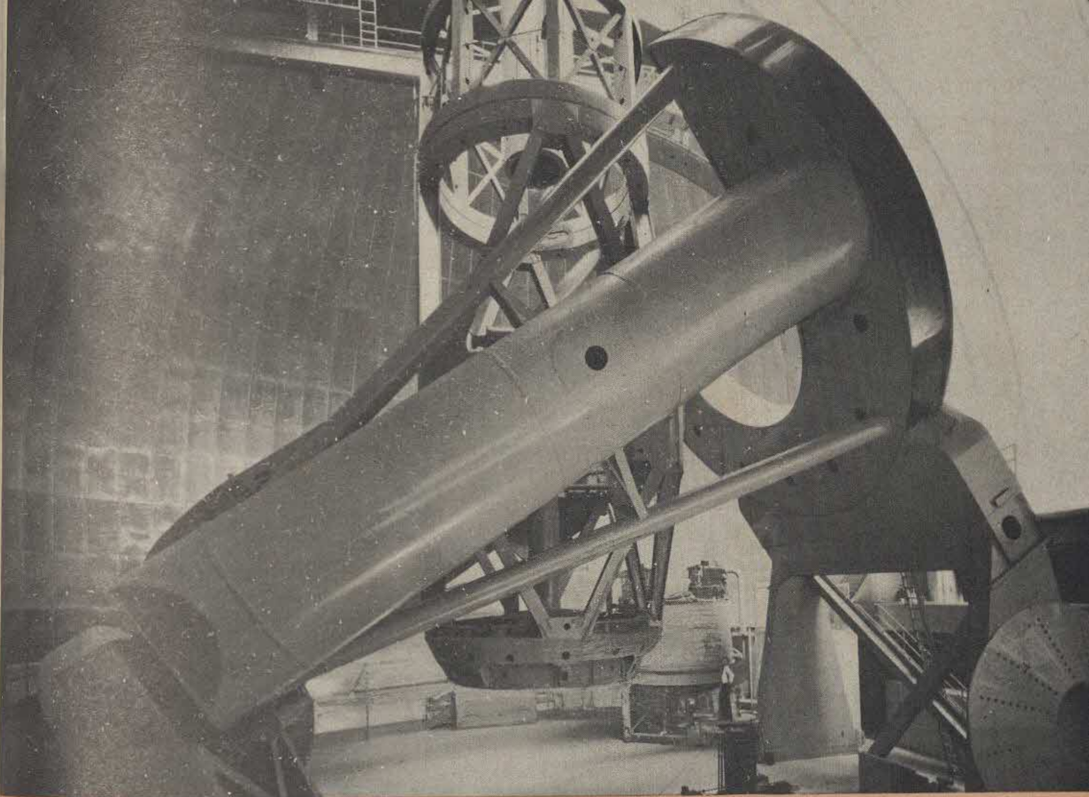
Some more recent developmeits are the coaxial cable, radio relay, the transistor, and long distance dialing. The coaxial cable transmits hundreds of telephone messages simultaneously, and also provides channels for television picture transmission. The cable houses four pairs of copper tubes. One tube in each pair transmits in one direction; the other in the opposite direction.

The radio relay system, which provides a total of 3,000 telephone circuits or ten one-way television channels, employs radio waves of super-high frequencies, called *microwaves*. Since these waves do not follow the earth's curvature, stations ranging up to four hundred feet high are spaced an average of thirty miles apart to catch the beams, amplify them, and focus them on the next station.

The transistor is a device about the size of a man's thumbnail which does the job of a vacuum tube. It controls the flow of electrons. It rectifies, amplifies, and oscillates a current. Through the use of the transistor, such developments as tiny hearing aids, midget portable transistor radios, and compact computers have become possible.

Direct-distance dialing, called *DDD*, enables an operator at a switchboard and, in some instances, the subscribers to dial a call directly to a telephone in a distant city in a very brief time.

TELEPHONE, Wireless. See Radio.



Mount Wilson and Palomar Observatories

"THE BIG EYE" — THE 200-INCH HALE REFLECTOR

Suspended on a massive mounting, this giant sometimes carries an astronomer in its upper tube.

TELESCOPE. To make far away objects seem closer so that we may observe and study them is the function of the telescope, the astronomer's most valuable instrument. Through it, men have discovered planets and stars and even other stellar systems. They have studied the spots on the sun and the extinct volcanoes on the moon. Because of the telescope, man's conception of the importance of the earth has been utterly changed. It has profoundly affected philosophy and offered new clues as to the origin of the earth. Telescopes have revealed uncounted millions of stars, and have unfolded before man a never-ending, always interesting drama, in a theater so vast it surpasses the imagination.

Galileo, although he actually was not the inventor of the telescope, was the first scientist to use it extensively. His instrument had one convex lens at one end of a tube and a concave lens at the other end. His first telescope, made in 1609, magnified only three times, but a later one he made increased images thirty-three times. Although this telescope was quite simple, it proved to be immensely valuable. With it the great Italian scientist was able to discover the phases of Venus, the spots on the sun (from which he deduced that the orb revolved on its axis), and the moons of Jupiter. Our opera glasses of today are actually two small Galileo telescopes.

There are two types of telescopes used by modern astronomers. These are the *refracting* and *reflecting telescopes* (see LENS; LIGHT). A simple refracting telescope makes use of a large convex lens at the outer end of a long tube. This arrangement causes the rays of light from the object to be refracted as they pass through the lens. The divergent rays are changed to convergent rays, forming an inverted image which is magnified by the eyepiece. If an erect image is desired, a pair of convex lenses is used between the objective lens and the eyepiece. The larger the lens, the brighter the image, and the longer the tube must be.

Reflecting telescopes use a mirror and a prism, and require shorter tubes. A lens or

Bausch and Lomb Optical Co.

FIRST CLOSE-UP LOOK AT SPACE

The telescope built by Galileo was a feeble thing compared with the giant instruments that pick up sights and even sounds far beyond our galaxy. But in 1609 his telescope enabled him to make important new discoveries about the moon, the planets, and the Milky Way.

RCA *Electronic Age*

COLOR ADDS DIMENSION TO TELEVISION

Color television has come a long way since the first experimental broadcast in 1940. The first nationwide network program in color was not given until 1954, but from then on color programs increased rapidly. Color adds enchantment to *Peter Pan* as Peter and the "Lost Boys" sing in the forest of Never-Never Land, above left, and Captain Hook flourishes a menacing hook, left. The studio, above, shows the equipment needed to film one scene in a popular variety show.

combination of lenses is used in the eyepiece, which is placed in the side of the tube toward the top end. The mirror is concave and silvered on the top side, and is placed at the lower end of the tube. The light rays from the star or other object are reflected by the mirror, and are then reflected at right angles and without refraction by the prism, forming an image close to the eyepiece.

The largest refracting telescope is in the Yerkes Observatory at Williams Bay, Wis. It has a forty-inch lens which weighs 760 pounds. The largest mirror for a reflecting telescope is installed in an observatory on Mount Palomar in California. It is 200 inches in diameter and is a Schmidt camera-telescope (see ASTRO-PHOTOGRAPHY). Also important is the radio telescope. Developed after World War II, it picks up electrical impulses, or signals, from stars, even those too distant to be seen, and enables astronomers to map them. See ASTRONOMY; OBSERVATORY.

TELETYPE. See TELEGRAPH.

TELEVISION. In the twentieth century three related forms of mass communication have been perfected: motion pictures, radio, and finally, television. Like motion pictures, television presents images to the eye. Like radio, it instantly brings distant sounds to the ear. But more than this, television, or TV, enables us to watch faraway events, as well as to hear sounds from distant locations, at the very moment of their occurrence. Within a few years after commercial television became a reality, TV had won the favor of the public just as radio had in the 1920's, and millions of sets were in use in various parts of the world.

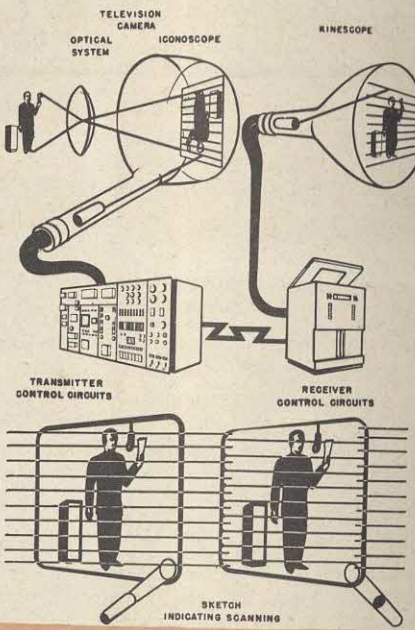
Television has the great advantage of presenting both sound and images at close range. In the home, a few feet from the TV set, we may watch every type of program from serious plays, discussions, and symphony concerts to comedy shows, vaudeville skits, and athletic contests. In classrooms television provides audio-visual instruction. In medical schools and hospitals, students witness telecasts of operations from the best possible location. The flights of pilotless planes and guided missiles are televised for observation and research. Science and engineering are both making use of TV in countless ways. The influence of this invention on habits, attitudes, and many other phases of modern living is widely recognized.

How Television Works. The lens of the television camera focuses the light rays from the subject being televised on a special type of electron tube. This tube transforms the picture into an electrical code message. The light rays fall on a sensitive plate at one end of the tube, setting free electrons which form a pattern corresponding to the pattern of light and shadow in the subject. In the simple *iconoscope,* this pattern is "scanned" with lightning speed by a stream of electrons streaming from an electron gun at the other end of the tube. Each time the beam swings across the plate, electrons return in greater or lesser strength, depending upon the pattern. This pattern of electrical impulses is amplified and transmitted, along with the accompanying "sound," as TV signals.

The very short television wave travels through space in a nearly straight line. Thus mountains or high buildings may obstruct it, or the curvature of the earth may cause it to be lost completely. Very high antennas are used by television stations, and radio relays are often used to bridge the distance between station and receivers. In other cases, special telephone cables carry the signal across a country or an ocean. See TELEPHONE.

When the signals reach the television receiver, the *kinescope,* or *picture tube,* turns the electrical pattern back into a pattern of light and shadow—re-creating the image of the televised subject. Again an electron gun is used. It scans a fluorescent screen, which produces the "picture" as it is struck by electrons fired in response to the incoming signals.

History. Many men of many lands helped make television possible. Their experiments continued for decades. Regular telecasts began in Great Britain in 1936 and in New York City in 1939. However television's greatest expansion took place after World War II. Almost immediately after the war ended, research on three-dimensional and transoceanic television was speeded up. More sensitive cameras and receivers were produced; the size of the picture tube was greatly decreased but there was an increase in the size of the picture; portable sets were developed; and ultrahigh frequency channels were put into use for better transmission and for an increased number of available channels. For many years the black and white picture was the only one available, but since 1954, color television has become popular. Programs ranging from musical comedy to outdoor sports, are regularly televised in color. See ELECTRONICS; RADIO.


TELEVISION CAMERA
OPTICAL SYSTEM
ICONOSCOPE
KINESCOPE
TRANSMITTER CONTROL CIRCUITS
RECEIVER CONTROL CIRCUITS
SKETCH INDICATING SCANNING

Courtesy Farnsworth

HOW TELEVISION WORKS

The image entering the camera is focused in the iconoscope. An electronic gun fires a stream of electrons at the screen, releasing electrical impulses which are picked up by the receiver and sent to the kinescope. There an electronic gun scans the screen, changing the electrons into light—the visible image.

TELL, William. Representative of Swiss love of independence is the story of William Tell, traditional hero of Switzerland. According to the tale, William Tell was an inhabitant of the canton of Uri in 1307, when the Swiss were oppressed by the Austrians. The high-spirited people resisted, but the Austrian bailiff, named Gessler, forced the Swiss citizens to pay homage to him. He placed his hat on a pole and commanded everyone to bow before it. Because William Tell refused to humble himself, he was condemned to die. The sentence, however, was changed, and Tell was promised his freedom if he would take the chance of shooting an apple off his young son's head.

Tell, an expert bowman, accepted the challenge, and sped the arrow to its goal. But afterward he exclaimed that, had he injured his son, he would have seized and killed Gessler. He was taken prisoner again for this statement. While being transported by his captors across a lake during a storm, he escaped. After swimming to shore, Tell sought out Gessler, found him, and killed him.

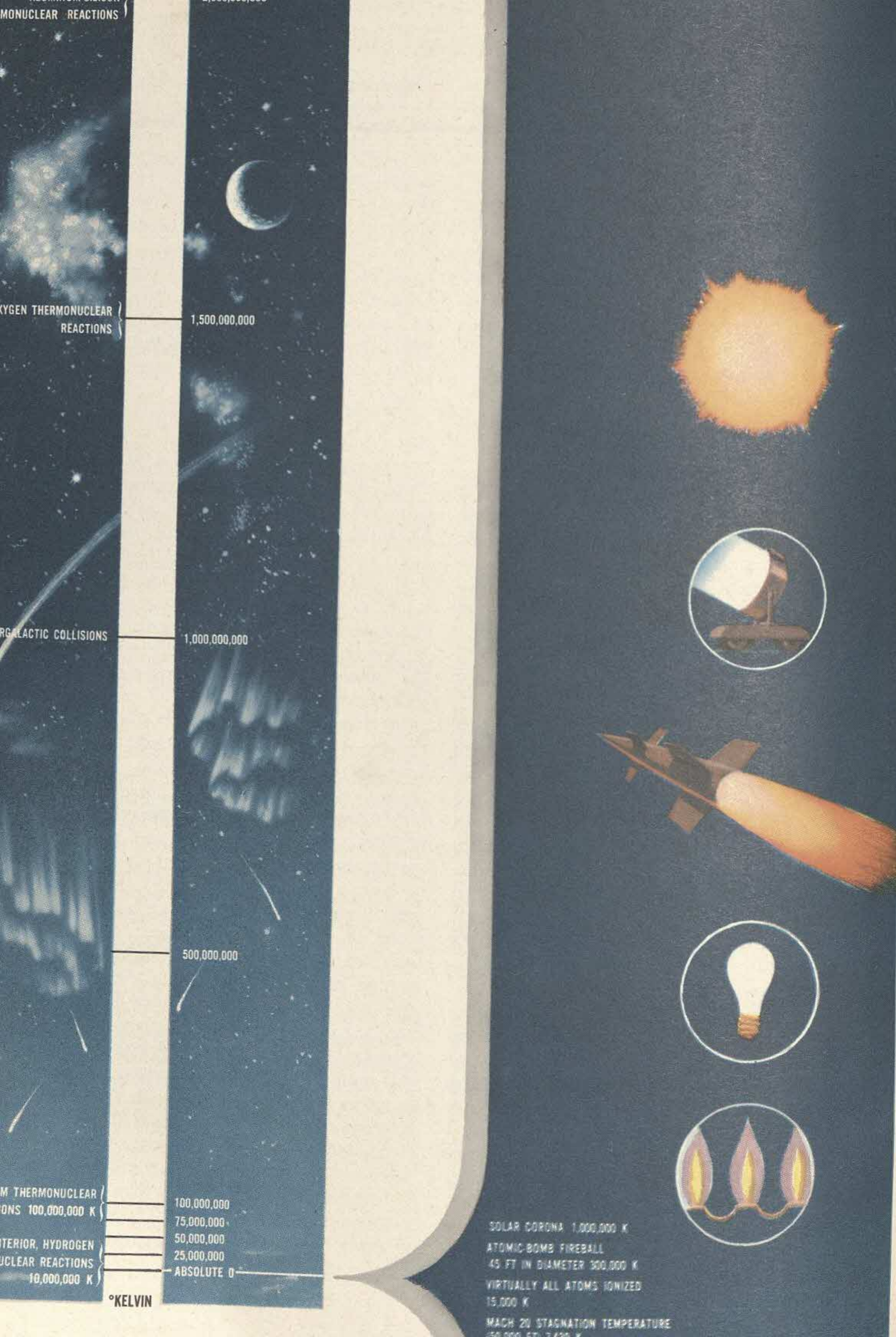
Gioacchino Rossini's opera *William Tell* tells the tale of the Swiss hero in four acts.

TELLURIUM, *teh lyu' rih um,* a semimetallic element that looks like a metal but acts like a nonmetal. It is used chiefly in the production of metal alloys, particularly with lead and with copper. Lead thus becomes more resistant to the corrosive action of acids, and copper is more easily machined into finished products. Persons who work with tellurium often find their breath acquires a characteristic odor of garlic.

TEMPERANCE. At one time temperance referred to habitual moderation in all practices. Today, however, it has come to mean chiefly the limited use of intoxicating beverages. Since ancient times most religions and philosophies have recommended temperance and condemned intemperance in drinking. In some countries of the world, during certain periods of their history, drunkenness became a serious social and economic problem. As a result, many civil, religious, and social organizations promoted movements and supported the enactment of laws to encourage temperance. Although few countries today completely prohibit the use of intoxicating beverages, the temperance movement is still very active. In the United States, the Woman's Christian Temperance Union, the Temperance League of America, and the National Temperance League are the leading temperance organizations. Alcoholics Anonymous is an organization of former drinkers, active in the reclamation of persons who have been alcoholics.

TEMPERATURE. The comparative degree of heat or cold possessed by a gas, a liquid, or a solid is said to be its temperature (see Heat). It may be measured, because by contact the heat of any body is always communicated to a cooler body until both reach the same level of heat. Thus, heat will be communicated from water in a pan to some measuring device placed in the water until the device attains a degree of heat equivalent to that of the water. To the human body, good conductors of heat will usually feel cold to the touch because they carry away the body's heat quite rapidly. Poor conductors usually feel as warm or warmer than the body. Temperature is commonly measured by means of *thermometers,* devices with graduated scales between two selected points, and reported in degrees Fahrenheit, Celsius (centigrade), or Kelvin (see Thermometer). For very specialized heat measurement, a *heat photometer* or a *pyrometer* is used. These are found chiefly in science and industry. By reading the markings on the measuring instrument, the temperature can be determined. Extremely high temperatures have been recorded, but the lowest known possible temperature, called *absolute zero,* has not quite been reached in the laboratory. It is equivalent to 0° Kelvin, −273.1° centigrade, and −459.7° Fahrenheit.

Two temperatures which vitally affect the conduct of our everyday lives are the temperature of the body (see Temperature of the Body) and the temperature of the


MONUCLEAR REACTIONS
XYGEN THERMONUCLEAR REACTIONS
1,500,000,000
RGALACTIC COLLISIONS
1,000,000,000
500,000,000
M THERMONUCLEAR
ONS 100,000,000 K
TERIOR, HYDROGEN
UCLEAR REACTIONS
10,000,000 K
100,000,000
75,000,000
50,000,000
25,000,000
ABSOLUTE 0
°KELVIN
SOLAR CORONA 1,000,000 K
ATOMIC-BOMB FIREBALL
45 FT IN DIAMETER 300,000 K
VIRTUALLY ALL ATOMS IONIZED
15,000 K
MACH 20 STAGNATION TEMPERATURE

atmosphere. The sun's rays are the source of the earth's heat, and seasonal changes in atmospheric temperature depend on the angle at which these rays strike the earth (see Climate).

TEMPERATURE OF THE BODY. A rise or fall in the temperature of the body, which normally ranges from 98.4° to 98.6° F., is used as an indication that the body machinery is not functioning properly. Wide variations of body temperature usually result in death, but in rare instances, persons have survived body temperatures as low as 65° F. and as high as 113° F.

TEMPERING. When heated metals are suddenly cooled, they become hard and tough. This process, called *tempering,* is especially used in the manufacture of iron and steel. Many tempered metals, however, are also brittle and must be reheated and cooled several times to remove the brittleness. Metals are cooled in water, oil, or molten metals, depending on their type and composition. See Annealing; Steel.

TEMPLARS, Knights. Foremost among the knightly orders founded during the Crusades was the Knights Templars, Nine French knights who had gone to Jerusalem in 1118 to war against the Saracens organized the Order of the Poor Knights of Christ, using the name Templars from Solomon's Temple in Jerusalem. The order was dedicated to protect the pilgrims in Palestine. It became very powerful but in the 1300's its members were subjected to persecution and the order destroyed. Modern Knights Templars are a high order in Freemasonry. See Crusades.

TEMPLE. Among ancient people, and some religions, great buildings, called temples, were erected for public worship. They were usually magnificently designed and decorated. Best known of the ancient temples were the Temple of Solomon in Jerusalem, the Parthenon in Athens, the Pantheon in Rome, and others in Egypt, France, Syria, India, China, and Japan.

TENACITY. When materials are subjected to forces that tend to pull them apart or crush them, cohesion, or action between the particles of the material, acts as a counterforce to resist the action. The measure of a body's ability to resist is called tenacity. Tenacity varies for all substances, even varying within the same substance in accordance with the direction in which the stress is applied.

See Cohesion; Strength of Material.

TENDONS. White, non-elastic structures of fibrous connective tissue that attach muscles to bones are called tendons. They may be cordlike, consist of fibrous bundles, or be thin and flat. They may be enclosed in smooth sheaths or kept in place by ring-shaped ligaments, as in the wrist. The tendon of Achilles is the strongest tendon in the body. Beginning with the muscles of the calf, it is inserted into the heel bone, and can support the entire weight of the body. See Muscle.

TEN'EMENT. See Housing Problem.

TENNESSEE, *ten eh se'*. Popularly called the "Volunteer State" because many of its men enlisted during the Mexican War, Tennessee is one of the South Central states. Its area of 42,246 square miles ranks thirty-fourth among the states. Its population is about 3,567,000. It is bounded on the west by the Mississippi River; north, by Kentucky and Virginia; east, by North Carolina; and south, by Mississippi, Alabama, and Georgia.

Surface Features. The eastern portion of Tennessee is high, the Great Smoky

TEMPERATURES ON EARTH ARE LOW BY COMPARISON

The extremely high temperatures created by some of man's inventions are insignificant compared with the temperatures possible in celestial bodies and in some nuclear reactions. By comparison, if the scale (far left on the opposite page) were enlarged to the height of the Empire State building, the temperature of an atomic fireball, 45 feet in diameter, would be only 2.6 inches from the bottom of the scale. Temperatures of rocket engines, light bulbs, and gas flames would fall even closer to absolute zero. The highest probable temperature is 2,000,000,000° Kelvin, found in the interior of the hottest star. The Kelvin scale, based on the centigrade scale, is obtained by adding 273.1 to the degrees centigrade. Absolute zero falls at −273.1° C.

Mountains containing some of the Appalachian System's highest points. Part of the scenic Great Smoky Mountains National Park is here. Between the Smokies and the lower Cumberland Plateau to the west is the Tennessee River's eastern valley. "Middle" Tennessee, stretching from the Cumberlands to that river's western course, and Western Tennessee, largely composed of Mississippi Valley bottom lands, are the state's best agricultural areas.

The Tennessee River crosses the state twice, and most of the huge dams and artificial lakes of its valley are there. Also important are the bordering Mississippi, the Cumberland, and the tributaries of the major rivers.

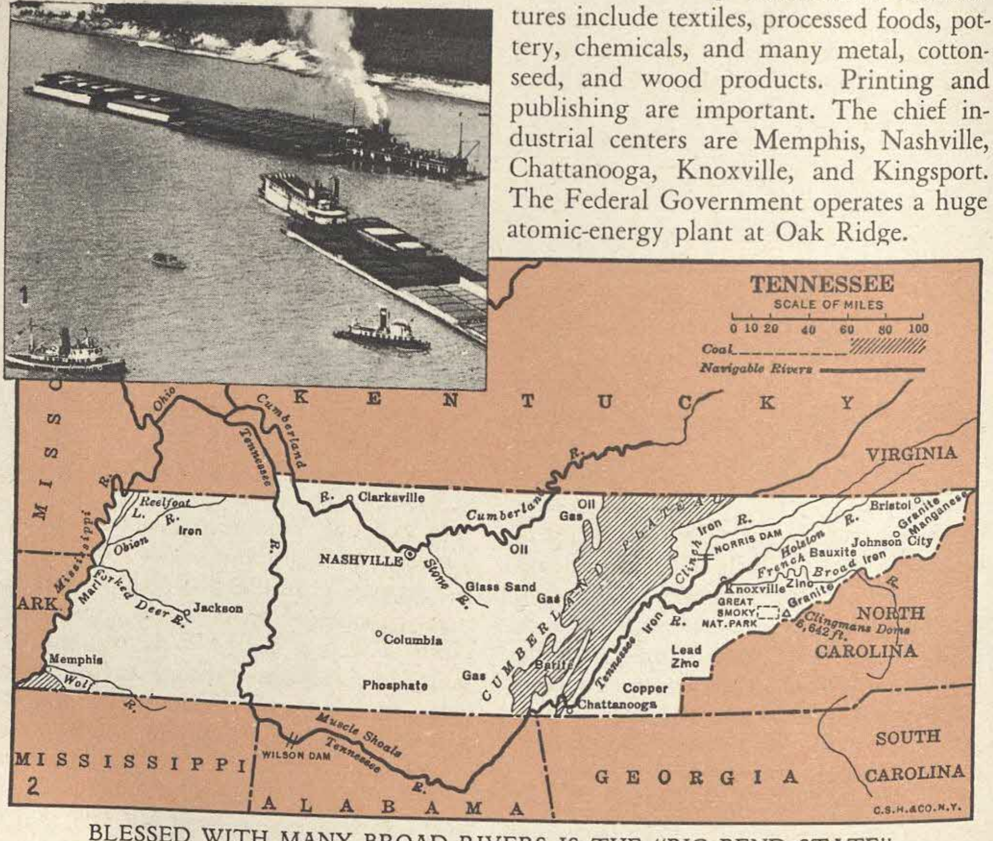
Climate. Tennessee's climate is generally mild, except in the mountains and in the west, where the summers are hot, humid, and subtropical. Its well-distributed rainfall averages about fifty inches a year.

Natural Resources. Soft coal, found chiefly in the Cumberland Plateau, is the most valuable mineral. Others include phosphate rock, marble and other building stones, copper and iron ores, zinc, lead, manganese, silver, gold, and clays.

Tennessee's extensive forests, chiefly located in the mountains, contain pines, cedars, and various hardwoods, including oaks and maples. Large areas have been set aside as state or national forests.

Agriculture. Major crops include corn, cotton, tobacco, peanuts, pecans, sweet potatoes, wheat, oats, soybeans, hay, sorghums, vegetables, and fruits. The bluegrass pastures of Middle Tennessee encourage livestock raising.

Manufacturing. Tennessee's manufactures include textiles, processed foods, pottery, chemicals, and many metal, cottonseed, and wood products. Printing and publishing are important. The chief industrial centers are Memphis, Nashville, Chattanooga, Knoxville, and Kingsport. The Federal Government operates a huge atomic-energy plant at Oak Ridge.



BLESSED WITH MANY BROAD RIVERS IS THE "BIG BEND STATE"

(1) Memphis, the state's only important port on the Mississippi, presents this scene of feverish river activity. (2) Map of Tennessee, showing the wealth of natural resources.

Nashville Chamber of Commerce

Chattanoogans,

AGRICULTURE, ART, INDUSTRY
Tobacco is Tennessee's second largest crop. The dark-fired variety, above left, is cured with heat and smoke rather than with air. Above right, Nashville's replica of the Athenian Parthenon, is visited by more than 200,000 people each year. Right, the state's high-grade ceramic clays are processed through extrusion presses to make parts for the electronics industry.

Transportation. Besides the great natural waterways of the state, transportation facilities include over 3,500 miles of steam railroad. There are also about 7,800 miles of highways.

Education. The state is reducing illiteracy by a compulsory-education law forbidding the employment of children under sixteen years of age in factories or mines. Separate schools are maintained for white and colored children. Institutions of higher learning include the University of Tennessee, the University of the South, the University of Chattanooga, Vanderbilt University, George Peabody College for Teachers, Fisk University (Negro), Maryville College, and Tennessee Polytechnic Institute.

Government. The general assembly of Tennessee consists of a senate of thirty-three members and a house of representatives of ninety-nine members, all of whom are elected for two-year terms. No clergyman is eligible to membership in either house. The governor serves for two years. At the head of the judicial system is a supreme court of five justices. Nashville is the capital.

The History of Tennessee. De Soto is believed to have been the first white man ever to set foot on Tennessee soil. He visited the region in 1541. Years later, when the French fur traders began to penetrate the Mississippi Valley, La Salle erected a fort near the present site of Memphis in 1682. After the middle of the eighteenth century, such hardy pioneers as Daniel Boone and James Robertson began to settle in Tennessee.

In 1772 the Wautauga Association was formed, and Tennessee organized a tentative separate government which lasted only four years before the area was annexed to North Carolina as the Washington District. In 1784 the territory again broke away, forming an individual state known as Frankland or Franklin. The new state was short-lived however, for Tennessee soon reverted to North Carolina and then to the Federal government. In 1790 it became known as "the Territory South of the

River Ohio." Six years later, Tennessee was admitted to the Union as the sixteenth state.

From this time on, Tennessee's growth was rapid, and thousands of immigrants poured into the state. When the Civil War broke out, Tennessee delayed secession until June, 1861. The state, divided in opinion, furnished 115,000 men to the Confederate army and 31,000 to the Union army; many of the bitterest fights of the four-year conflict took place within its borders. In 1866 Tennessee was readmitted to the Union. The Tennessee Valley Authority (TVA), instituted in 1933, was designed to provide the state with cheap hydroelectric power and to plan for the economic and social well-being of the people.

Consult the following titles for additional information:

Boone, Daniel
Chattanooga, Battles of
Civil War in America
Cumberland Mountains
Fort Henry and Fort Donelson
Memphis
Mississippi River
Nashville
Tennessee River
Tennessee Valley Authority

TENNESSEE RIVER. The largest tributary of the Ohio River is the Tennessee River, formed by the union of two rivers, the Holston and the French Broad, which rise in the Appalachians and meet in Eastern Tennessee four miles above Knoxville. This river follows a meandering course from the source of the Holston southwestward through Tennessee into Northern Alabama, then turns northwestward touching the northeastern corner of Mississippi and re-entering Tennessee; thence it flows north into Kentucky and northwest to the Ohio River at Paducah. From the junction of the two branches, the Tennessee is 652 miles long. This river is an integral part of the Tennessee Valley Authority flood-control and water-power project. See Tennessee Valley Authority.

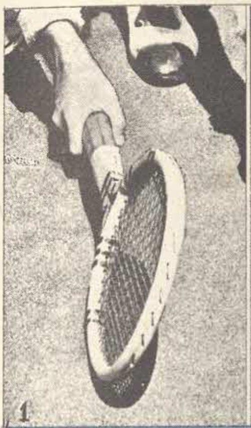
TENNESSEE VALLEY AUTHORITY. Along the Tennessee River, whose drainage area includes parts of Kentucky, Tennessee, Alabama, Virginia, North Carolina, Georgia, and Mississippi, the United States Government has engaged in a colossal program of dam building, power production, and flood control. The Tennessee Valley Authority (TVA), established by Congress in 1933, was an outgrowth of the Muscle Shoals-Wilson Dam project undertaken during the First World War. Among the many dams now included under the TVA are Norris Dam, Wheeler Dam, Wilson Dam, Fontana Dam, Kentucky Dam, Douglas Dam, Cherokee Dam, Hiwassee Dam, Fort Loudoun Dam, Watts Bar Dam, Chickamauga Dam, Guntersville Dam, and Pickwick Dam.

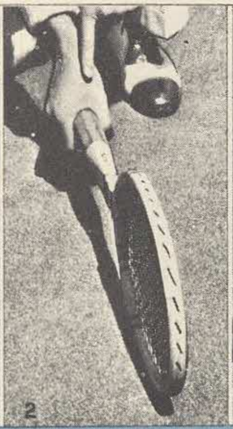
The territory affected by this vast project is an area of about 41,000 square miles. Besides the inhabitants of the region, who are directly affected, millions more in adjacent areas are indirectly affected.

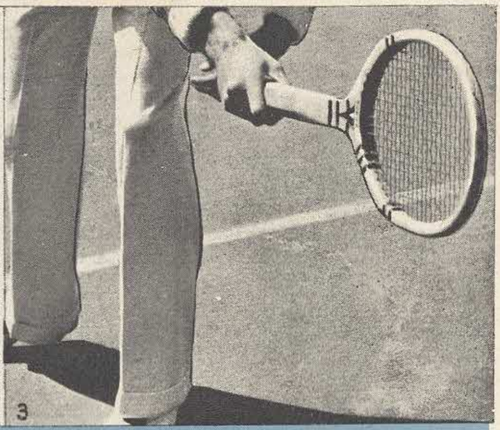
The purposes of the Tennessee Valley program are numerous. The broad objective is the economic and social well-being of the people of the Tennessee Valley. Specifically, the TVA proposes to improve navigation facilities, control floods, generate electric power, serve as a "yardstick" to determine the relative costs of public- and private-power production, lower the cost of fertilizers, and aid the national defense by providing a means for the manufacture of nitrates. The TVA has also inaugurated a program of erosion control and reforestation in the region which it serves.

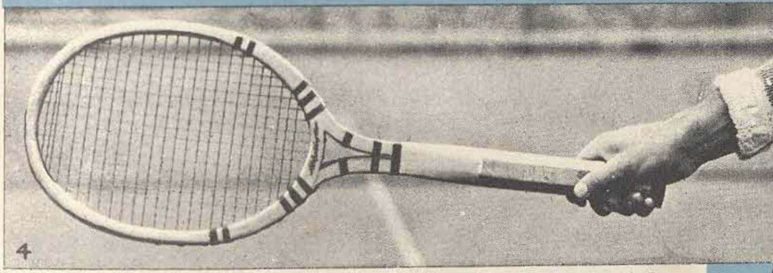
In January, 1939, the Supreme Court upheld the constitutionality of the government program. Following this decision, the TVA purchased the Tennessee electric properties of the Tennessee Electric Power Company, a private utility.

Organized as a corporation, the TVA is managed by a board of three directors appointed by the President and confirmed by the Senate. In carrying out the objectives laid down by Congress, the board has considerable freedom of action. The net profits earned from the sale of power and phosphate fertilizer go into the Federal Treasury. The fame of the TVA is worldwide. See Muscle Shoals; Reclamation, Bureau of; Tennessee River.





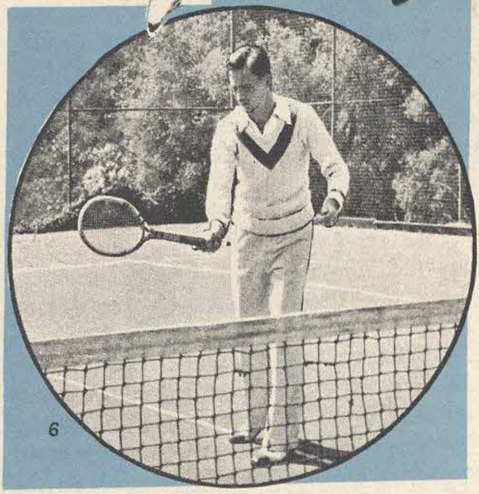




Courtesy A. G. Spalding & Bros.

WHERE SPEED AND SCIENCE ARE AT A PREMIUM

(1) The composite grip. Note that the racquet is turned slightly to the left. (2) The Eastern grip. The racquet is stood on edge and firmly gripped as though the player were shaking hands. (3) The follow-through of a low forehand drive. Both body and knees are bent. (4) Rear view of backhand grip. The thumb, held on the flat surface of the handle, prevents the racquet's turning. (5) Absolute poise and balance are essential at all times. As in golf, the player must always keep his "eye on the ball." (6) The forehand volley, which requires the same grip as the forehand drive.



TEN'NIS. Similar to squash and handball, the game of tennis was played on a four-walled covered court. It differed from these games chiefly in that racquets and twine or cloth tennis balls were used. The object of the game, which was popular among French and English nobility from the fourteenth to the seventeenth centuries, was to make an opponent miss the ball before its second bounce, thus giving the server a point. The game is not to be confused with lawn tennis.

Lawn tennis is played on a turf or hard court with a net across the center. Two or four may play.

VICTORIAN POET LAUREATE
The Lady of Shalott is shown making her fateful last journey in a famous painting by Waterhouse (left). Right, Tennyson, her chronicler.

TEN'NYSON, Alfred, first Baron Tennyson (1809-1892). Just as Dickens, Thackeray, and George Eliot brought luster to the Victorian Age in the field of the novel, so Tennyson was one of the foremost writers who contributed to the great poetry of that Golden Age of English literature. He was born in Somersby, Lincolnshire; was sent away to school for five years when he was six years old; and then was prepared for Trinity College at Cambridge by his father, a parish rector, entering in 1828. At Trinity, Tennyson's talents soon attracted attention, and in 1829 he was awarded a medal for the poem, *Timbuctoo*. Two years before, he had published *Poems by Two Brothers*, written with his brother Charles. These poems, however, were immature, and it was a volume entitled *Poems, Chiefly Lyrical*, published in 1830, that revealed his true genius.

Two years later some of his finest verses appeared—*The Lady of Shalott, Oenone, The Lotus-Eaters,* and *A Dream of Fair Women*. The following year the poet's beloved friend, Arthur Henry Hallam, died, and for nine years Tennyson shut himself off from the world and devoted himself to his work. The result of these years of brooding and study was manifest in the two volumes published in 1842. Decidedly more mature and powerful than anything he had done previously, the poems included *Morte d'Arthur, Dora, Locksley Hall, Ulysses, The Two Voices,* and *Break, Break, Break*.

Tennyson was now recognized as the ranking poet of his time, and in 1847, when *The Princess* was published, even greater fame was his. His masterpiece, however, was *In Memoriam* (1850), regarded by many as the finest eulogy ever written. In it are contained all the doubts and personal sufferings Tennyson experienced after the death of his friend Hallam; there, too, he expressed the final triumph of faith that comes with maturity. In 1850 Tennyson succeeded Wordsworth as poet laureate.

The rest of Tennyson's career was made up of alternate successes and less popular works. The volume *Maud, and Other Poems,* written in 1855, was received coldly; but four years later the *Idylls of the King* was immensely popular. *Enoch Arden,* published in 1864, also was successful. Tennyson attempted dramatic writing at the end of his career, but he was not a gifted dramatic writer, for he was essentially a lyric poet. Although he had refused a baronetcy in 1873 and again in 1874, he finally accepted a third offer in 1884. *Demeter and Other Poems,* containing *Crossing the Bar,* was published in 1889. Tennyson died at Aldworth, the home which he built to secure privacy for his work. His tomb is in Westminster Abbey.

TENT. See CAMPS AND CAMPING.

TENT CATERPILLAR. This name is applied to several species of injurious insects that, in the larval stage, feed on fruit and forest trees. The most common and widespread is the *apple-tree* tent caterpillar, found throughout the United States from the Rocky Mountains eastward. The *forest* tent caterpillar has similar range and habits. Two closely related species occur on the Pacific coast.

The dense white webs, or tents, of the caterpillars, stretched in the crotches of the branches, are very noticeable. An entire colony of larvae, when not feeding, passes the time in a tent. The eggs are deposited in masses encircling the small twigs. As soon as they are noticed, the webs and egg masses should be cut off and burned. Lead arsenate is a preventive in apple orchards.

TENURE OF OFFICE ACT. Passed in 1867 as a curb on the power of President Johnson, the Tenure of Office Act provided that the Chief Executive could remove no appointed subordinate from office without the consent of the Senate, if the appointment had been made with the consent of that body. The act, unprecedented in American history, also included Cabinet officers in its scope.

About a year after its passage, Johnson deliberately disregarded it in his removal of Secretary of War Stanton, a move which hastened impeachment proceedings. The act, considerably modified in 1869 during the administration of Grant, was repealed entirely in 1887. See JOHNSON, ANDREW.

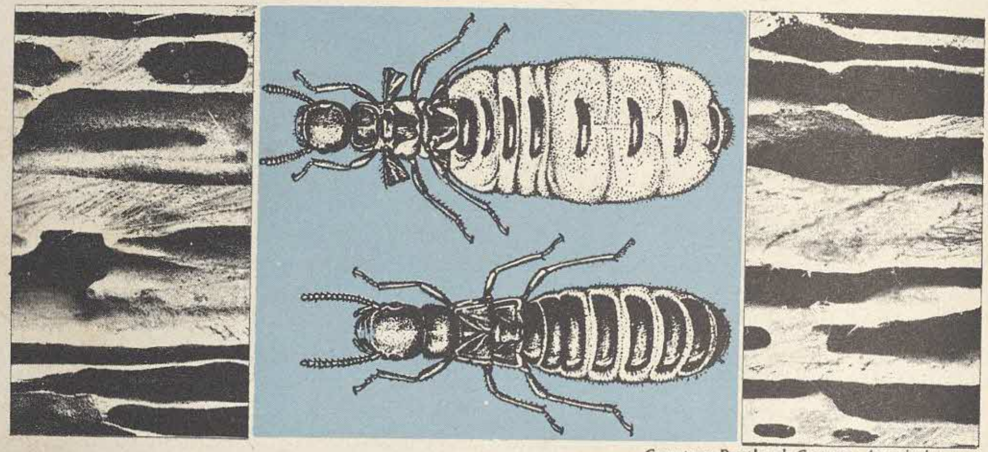
TEPE GAWRA, *te' pe gow' rah.* About fifteen miles north and east of Mosul and Nineveh, in modern Iraq, on a gently rolling plain which edges a great bend in the Tigris River, is one of the ancient cities of the world—Tepe Gawra, or *Great Mound.* The site of Tepe Gawra is a huge mound of earth, nearly seventy feet high and 500 feet in circumference, which contains the ruins and relics of sixteen successive human settlements, one built upon the other in layers. The upper layers of the mound belong to a period between 1700 and 1400 B. C., and the lowest go back to 6000 B. C., well into the New Stone Age. The excavation of the site is a project of the American School for Oriental Research at the University of Pennsylvania.

Acme

SITE OF SIXTEEN-LAYERED CITY
Forty centuries old is this Tepe Gawra temple.

The area in which the mound of Tepe Gawra is located was first mentioned as being of historical interest by an English scientist, Sir Austen Layard, in a book published in 1853. However, there was no excavation until 1927, when a trial trench was dug. This showed that the mound would yield valuable information as to the history and culture of ancient Mesopotamia. In 1930 the work of excavation was begun, and it continued intermittently for many years. See ARCHAEOLOGY.

TERMITES, *tur' mites.* Commonly called *white ants,* termites as a class are generally tropical, but some of them are found in America as far north as Canada. While they are not related to the true ants, they



Courtesy Portland Cement Association

MINING MENACE TO WOODEN STRUCTURES

Center, above, destructive, timber-consuming termites, magnified approximately ten times.

belong to the group of social insects including bees, wasps, and ants.

In all species, termites live in colonies. A colony consists of a king and queen, or male and female, and a large number of workers and soldiers. The workers and soldiers are individuals of either sex which have not developed to reproductive maturity.

The males and females have two pairs of long, narrow, white wings at time of maturity, but the wings are broken off after flight, and thereafter these individuals, like the workers and soldiers, are wingless. The bodies of the males and females are black, while those of the workers and soldiers are a dirty white.

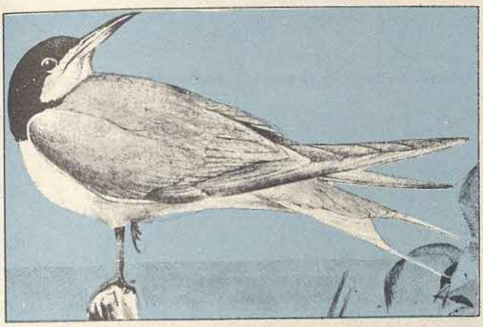
At the time of flight, which is usually in the spring, the winged individuals frequently appear in enormous numbers and light or fall at different places, so that they are readily distributed. They set to work to form new colonies, which, however, they cannot do unless some of the workers are also located at the same place. No doubt most of them die off without establishing new colonies, for lack of workers.

The colonies, or nests, occur under and in logs, in fence posts, boards, timbers of buildings, and trunks of trees. Frequently, in order to reach their desired food, they construct several covered passages over the surface of stone, brick, or cement, through which they pass. They are a serious menace to wooden trestles and bridges which are likely to have sudden weight thrust upon them. In feeding, the termites eat out the inner parts of the timbers, leaving an outside shell; thus the timbers are weakened before any indication is seen upon the surface. They also attack papers, books, leather, cotton and woolen cloth, and field crops.

The best methods of control are preventive ones. Bridges and trestles should be on brick, stone, or concrete foundations. Foundations of buildings should be high enough so that no wood will come in contact with the ground. Steps and walks should be cement, brick, or stone. No wooden support posts should be used, and wooden floors in basements should be removed.

Tropical species cement bits of earth together with saliva, and build mound-shaped nests that may be fifteen feet high.

TERN, *turn.* Closely related to the gulls, terns are a group of birds often called *sea swallows* because of their narrow, pointed wings and graceful flight. They have forked tails and long, straight bills. Black, pearl-gray, and white are the typical colors of their plumage. Terns are found commonly along the coast, on islands, and on



THE "MACKEREL GULL"
Great flocks of terns circle over schools of mackerel, show fishermen where to draw their nets.

inland waters, rather than over the open sea. In flying they often point the bill downward instead of straight ahead like the gulls, and they dive skillfully for small fishes. Most species of North American terns have a more southern range than do most gulls, though a few, like the *Arctic* tern, breed far north.

In general, American terns are smaller than gulls, but they vary in size from the *least* tern, which is but little larger than a robin, to the *Caspian* tern, nearly two feet in length. They live and nest in colonies, and were formerly very abundant. Large numbers were killed for their plumage, but they are now protected by law, and in some localities wardens are stationed to see that they are not disturbed.

TER'RA COT'TA. Used as early as 3000 B. C. for decorative statuary, vases, and tiles, terra cotta, a material made from baked clay, is now widely employed in pottery making, fireproofing, and in building construction. It is also used for garden ornaments, fountains, and interior decoration. Clay, stripped from the earth, is mixed with water, sand, and other suitable material to make a stiff mud. This mixture is then shaped by hand or in a mold and baked.

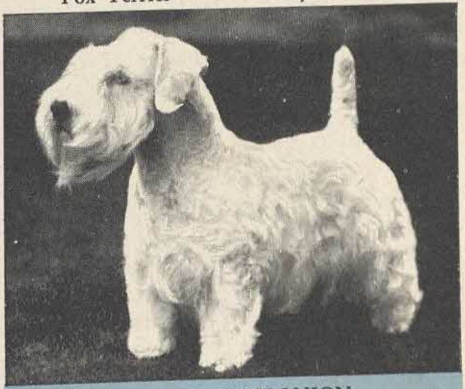
Terra cotta is produced in many different colors, the most common color being a rich, warm red. Its surface is frequently glazed. In buildings, terra cotta is used particularly for ornamental cornices, floor arches, and wall tile. Glazed terra cotta is considered a desirable surfacing for city buildings because it can be readily cleaned. See POTTERY.

TER'RAPIN. The fable of the hare and the tortoise was not written of the terrapin, for it is the most active of all the turtle family. Terrapins are largely of American origin, and twenty species are scattered through the brackish marshes of the United States from New York to Texas. The terrapin is protected by a rough, domelike shell into which it draws its head and feet when danger threatens. Like other turtles, terrapins are excellent swimmers. They feed on small fish, reptiles, and vegetation. Best known of the terrapins is the *diamond-back,* a resident of the South Atlantic salt marshes which is often raised for the market. Terrapin flesh is considered a great table delicacy.

TER'RIER. Full of life, loyal, and intelligent, terriers are probably the most popular type of dog. Formerly, they were used by hunters to track out small game from their holes, but terriers are commonly kept as pets today. The well-known breeds include the Airedale, Boston, black and tan, bull, cairn, Dandie Dinmont, fox, Irish, Scotch, Sealyham, Skye, Welsh, West Highland, and Yorkshire.

The following breeds are described in these volumes under separate headings:

Airedale
Fox Terrier
Scotch Terrier
Skye Terrier



ALERT COMPANION
A typical terrier in liveliness, courage, and pleasing personality, the Sealyham is increasingly popular as a house dog and companion.

TER′RITORY. In the United States the term *territory* designates an area which is not a part of any state and which is not a state itself. A territory is, however, similar to a state but not so independent. It is controlled directly by Congress under a governor appointed by the President. A territory has its own legislature elected by the people and elects a delegate to Congress, but the delegate may not vote in Congress.

Puerto Rico, formerly a territory, became a free commonwealth associated with the United States in 1952. In 1959 Alaska became the forty-ninth state and Hawaii the fiftieth state in the Union. Both were former organized territories of the United States. The Virgin Islands, Guam, American Samoa, the Ryukyu Islands, Midway Islands, and Wake Island are territories of the United States.

TER′ROR, Reign of. The streets of Paris literally ran with blood during fifteen months of the French Revolution. This turbulent period, known as the Reign of Terror, began with the appointment of the Revolutionary Tribunal and the Committee of Public Safety in the spring of 1793, and ended with the death of Robespierre in July, 1794. During the intervening months, hundreds of persons, including Danton and other Jacobin leaders, were put to death on the guillotine, as one man after another sought to take control of the government.

Behind the Reign of Terror was the theory that only by extermination of all opposition tending to weaken the unity of the people could the Revolution succeed. Such a policy soon exceeded all bounds of reason. The result, after Robespierre's death on the guillotine, was a reaction toward conservatism. See French Revolution.

TES′LA, Nikola (1857-1943). The practical development of electricity owes much to Nikola Tesla, an electrical engineer who was born in Austrian Croatia (now in Yugoslavia). He was educated in the Polytechnic School in Graz and at universities in Budapest and Prague, and afterward worked as a telegraphic engineer for the Austrian government. In 1884 he went to America, became a naturalized citizen, was associated with Edison in research, and then set up his own laboratory in New York.

Tesla discovered the principle of the rotary magnetic field, which he applied to the induction motor. He originated an effective method of using alternating current for the transmission of power, and designed the mammoth hydroelectric plant at Niagara. Tesla also made valuable contributions to the science of radio, and made improvements in arc lighting, incandescent lighting, dynamos, and condensers.

TEST ACTS. At one time, English laws required that all persons holding public office should adhere to the faith of the Church of England. These Test Acts, passed in 1673, prevented any Roman Catholic from holding public office. They were later extended to include members of Parliament. Most of the Test Acts were repealed in 1828.

Dallas Chamber of Commerce

TEXAS STATE FAIR IN DALLAS

Texas Hall of State (center building), honoring state's heroes, is part of State Fair Grounds.

TEX′AS. The "Lone Star State" has the distinction of being the second largest state in the Union, with an area of 267,339 square miles. It is larger than France and England combined. Texas is also distinguished for the fact that it is the only state to have been an independent republic before becoming a part of the United States.

TEXAS BEEF ON THE HOOF

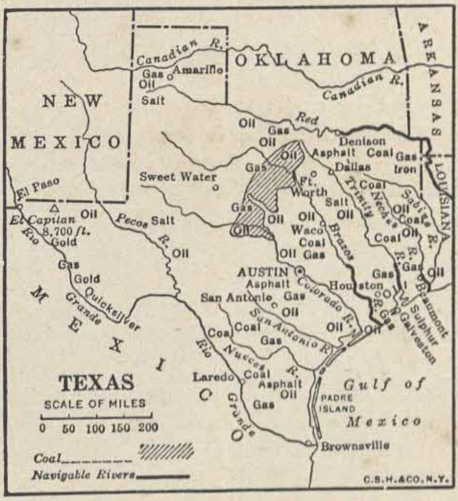
A herd of whiteface Herefords pauses for refreshment in a cool stream on a ranch near Jourdanton in south central Texas. The state ranks first in cattle production in the United States, raising about 9 per cent of nation's total.

U.S. Soil Conservation Service

The state is bounded by the Gulf of Mexico on the southeast, by Louisiana and Arkansas on the east, by Oklahoma on the north, by New Mexico on the west, and by the Republic of Mexico on the south and southwest.

Surface Features. The land of Texas slopes to the southeast and consists of plains and plateaus broken occasionally by hills and mountains. The state can be divided into several distinct geographic regions. The first is the narrow coastal plain which extends along the Gulf for about 400 miles. West and north of the coastal plain are the Black and Grand Prairie regions. Farther west are the Great Plains, really a plateau. Still farther west is the high, level area known as the Staked Plain. Lying between the Pecos and Rio Grande rivers is a mountainous area, containing spurs of the Rocky Mountains, the highest point of which is 9,000 feet above sea level.

The most important rivers are the Trinity, Brazos, Colorado, Guadalupe, San Antonio, Nueces, and Rio Grande, all of which flow into the Gulf of Mexico. Crossing the Panhandle (the rectangular northern projection of Texas) is the Canadian River, which flows eastward into the Arkansas. The Pecos River is the chief tributary of the Rio Grande, the river which forms the boundary between Texas and Mexico.



Climate. Warm weather prevails along the Texas coast, but the climate toward the northwest is subject to great extremes and more sudden changes. The eastern part of the state is humid, with fifty or sixty inches of rainfall annually, diminishing toward the west. The average temperature is about 70°F.

Natural Resources. Of all the valuable mineral resources in Texas, petroleum is by far the most important. The state ranks first in the production of petroleum, almost forty per cent of the petroleum of the United States coming from Texas. There are also plentiful supplies of natural gas. More than three fourths of the country's sulphur is also mined in Texas. The state also leads in the production of helium, the

INLAND PORT
The Houston Ship Channel, top, stretching inland fifty miles from the Gulf of Mexico, has made Houston one of the great ports of the United States. A turning basin in the city's manufacturing district permits ships to turn around for the trip back. The battleship "Texas," left, veteran of two world wars, is moored permanently near San Jacinto battleground, where Texas won her independence from Mexico. San Jacinto monument, in background, commemorates the battle.
Houston Chamber of Commerce

non-inflammable gas used in dirigible aircraft. Other valuable minerals are coal, quicksilver, gypsum, salt, silver, granite, sandstone, and limestone.

The state has thousands of square miles of timberland, most of which lies in Eastern Texas. Yellow pine is the chief commercial lumber.

Farming in Texas. Texas is one of the great agricultural states of the Union. Because of its variety of soils and climate, nearly every kind of warm-temperate crop can be raised. The chief crop is cotton, in which Texas often leads all other states. Other crops of importance are corn, sugar cane, wheat, oats, potatoes, rice, hay, tobacco, barley, and rye. Oranges, grapefruit, peaches, strawberries, pecans, and peanuts are also grown in large quantities. Truck gardening has become important. Irrigation is used extensively in the western part of the state.

The wide, level plains of Texas provide excellent grazing for livestock. Much of the western land consists of large ranch areas on which are raised vast numbers of cattle, sheep, hogs, horses, and mules.

Manufacturing and Commerce. The leading industrial enterprises are petroleum refining, flour milling, meat packing, and the production of lumber products and cottonseed oil and cake. Other industries include railroad-car construction, rice polishing, sugar refining, foundry and machine-shop work, the canning of fruits and vegetables, and the manufacture of clay products, leather goods, and cotton goods.

Texas leads the nation with about 15,500 miles of railroad, located chiefly in the northeastern and central parts of the state. The industrial development of the state has made necessary the construction of deep-water ports. The chief ports are Galveston, Houston (at the head of a fifty-mile ship channel to the Gulf), Corpus Christi, Beaumont, and Port Arthur. Freight moves on the Gulf Intracoastal Waterway connecting Brownsville, Texas, with Carrabelle, Fla. The chief exports of Texas include cotton, rice, petroleum, lumber, hardware, livestock, wool, wheat, and sulfur.

The People and Their Government. Native-born whites constitute the largest element of the population of Texas. There are large Negro and Mexican minority groups in the state. The total population of Texas is more than 9,589,000. More than half the people live in the rural areas. The chief cities are Houston, Dallas, San Antonio, Fort Worth, El Paso, Beaumont, Austin (the capital), and Galveston.

Texas has a state legislature consisting of a senate of thirty-one members elected to four-year terms and a house of representatives of 150 members elected to two-year

San Antonio Chamber of Commerce

Texas Highway Department

TEXAS—WHERE HISTORY MERGES WITH EXPANSION

Alamo Plaza, above, in San Antonio marks the site where the bodies of the heroes of the Alamo were piled and burned. On the base of the monument are inscribed the names of the 187 men who died in the battle. The new Federal building and post office are in the background. Rice harvesting in Texas is speeded up by the use of combines, above right. The harvest usually begins in August and lasts until November. Texas tops all other states in rice production. A network of long pipelines fans out from a natural gas plant in Carthage, right, where huge towers stretch skyward. Texas produces more than a third of the nation's oil and nearly half of its gas.

terms. The governor is elected to a two-year term. The supreme court heads the judiciary.

Education. The school system of Texas, one of the best in the country, is comprised of thousands of public schools, which are supported by one of the largest permanent school funds in the nation. State-supported institutions of higher learning include the University of Texas at Austin and such allied schools as Texas Western College in El Paso; the Agricultural and Mechanical College of Texas at College Station; Texas Technical College in Lubbock; Texas State University for Negroes in Houston; and Texas Agricultural and Mechanical College for Negroes in Prairie View.

Among the private institutions of higher learning in Texas are Baylor University in Waco, Texas Christian University in Fort Worth, Southern Methodist University in Dallas, Rice Institute at Houston, and St. Mary's University at San Antonio.

History. The first white man to visit what is now Texas was Cabeza de Vaca, who came in 1528. The first permanent settlement was not far from the present site of El Paso and was founded by the Spaniards in 1682. The French explorer La Salle founded a colony on Matagorda Bay in 1685, but it lasted only a short time. Later, Texas fell under the domination of Spain, and Catholic priests began to work among the Indians and to establish missions. When Mexico became an independ-

Texas Highway Department

SHRIMP BOATS LINE UP FOR THE DASH TO GULF WATERS

Drying nets frame a line of boats at the docks in Corpus Christi. Derricklike devices hoist loaded nets aboard. Texas and Louisiana lead all other states in shrimp production.

ent republic, Texas was a part of one of the states.

Many Americans migrated to Texas after 1821 and founded settlements, led by Stephen F. Austin, "the father of Texas." Harsh laws passed by the Mexican government and a desire for self-government led the Americans to revolt under the leadership of Sam Houston. The Texans won a final victory in 1836. Although the Republic of Texas was set up, it was not recognized by Mexico. The admission of Texas to the American Union at the end of 1845 marked the beginning of the war between Mexico and the United States. Texas seceded from the Union in the American Civil War, but was readmitted in 1870.

For further information consult the following titles:

Alamo
Austin (city)
Austin, Stephen Fuller
Dallas
Guadalupe Hidalgo, Treaty of
Houston (city)
Houston, Sam
Mexican War
Red River
Rio Grande
San Antonio

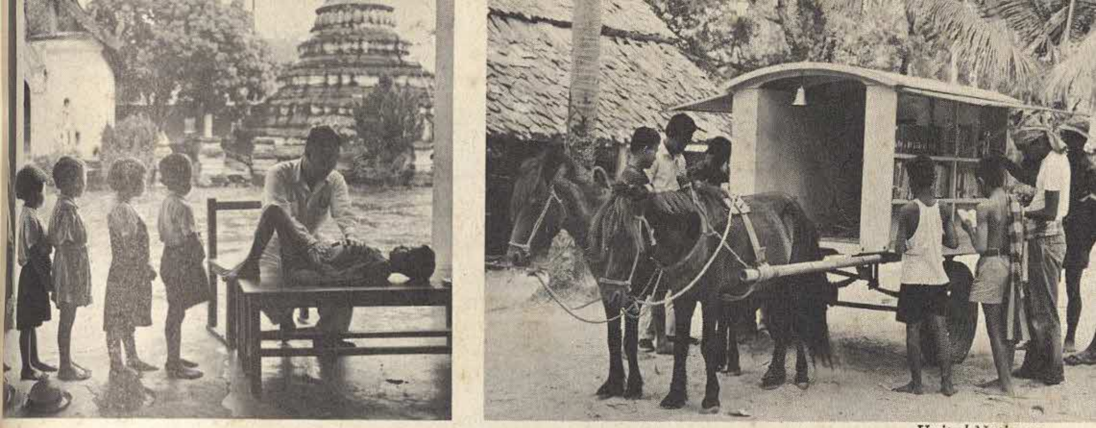
TEXTILE, *teks' til.* Material that is woven may be considered a textile. Textiles have many uses for clothing, for the home, and for industry. Natural fibers used in these materials include wool, flax, cotton, and silk. Man-made fibers, which have become increasingly important, include rayon, acetate, nylon, Orlon, Acrilan, Dynel, Dacron, and many more. Glass and asbestos can also be woven.

Textile manufacturing is a world-wide industry. Probably at least one fifth of the world's working population is occupied either with weaving and its allied trades, or with the distribution of its finished materials. Textiles are exceeded in value only by those basic commodities — food products and iron and steel.

This great industry is based primarily on a few principles of spinning and weaving which were developed by primitive man ages ago. In Egypt, Babylonia, Phoenicia, Greece, Rome, Europe, America, and the Orient, the principles were the same, but until the latter part of the 1700's, the textile industry was confined to the home. The invention of the power loom, the spinning jenny, the cotton gin, and other devices made mass production possible. The Industrial Revolution, the factory system, and the growth of labor unions were due, in a great measure, to the change in the methods of textile manufacture.

For added information, see:

Cotton
Dress
Factory and Factory Legislation
Fiber
Flax
Linen
Silk
Silk, Substitute
Spinning
Weaving
Wool



United Nations

THAILAND WORKS TO STAMP OUT DISEASE AND ILLITERACY

A Thai doctor, left, examines children in front of an ancient temple. Ringing bell announces the arrival of the pony cart library, right, with books and reading material for the villagers.

THACK'ERAY, William Makepeace (1811-1863). An outstanding novelist of the Victorian Age, Thackeray pictured the foibles and shams of society with satire and wit. He made his characters so lifelike that his novels give a remarkable picture of English life in the 1700's and 1800's. His novel *Vanity Fair,* first published serially in 1846-48, and succeeding novels were very successful.

Thackeray was born in Calcutta, India, attended the Charterhouse School in London, and studied law at Cambridge. After studying art for several years in Paris, he started writing for a living in 1837. His writings include *The Book of the Snobs; Pendennis;* and *The Newcomes.* The *Virginians,* a sequel to *Henry Esmond,* is about colonial life in the United States.

THAILAND, *tī' land,* or **SIAM.** This country is located on the Gulf of Siam in southeast Asia. It is bounded by Burma on the west and northwest, Laos on the northeast and east, and Cambodia on the southeast. A slender strip of the country on the west extends down the leg of the Malayan peninsula. This portion is bounded on the south by the Federation of Malay. To the west of this strip is the Andaman Sea of the Bay of Bengal. The Thai call their country *Muang Thai* which means *land of the free*. In 1939, the government adopted the name of Thailand in place of Siam. Thailand is the country of the book and motion picture *Anna and the King of Siam* and the musical comedy *The King and I.* It has an area of 200,148 square miles, and a population of 21,500,000. Its largest city and capital, Bangkok, has about 1,773,000 people.

The People. The Thai are a Mongolian people closely related to the Laotians of Laos and the Shans of Burma. They speak the Thai language and are Buddhists. The men and women rarely exceed five feet and three inches. They are a light-hearted people, fond of music and dancing, but proud and independent in defense of property rights. There is no caste, and women have a high position in the country. Education is compulsory from the ages seven to fourteen. There are many universities and colleges. The Chinese form a minority of about 3 per cent, and control most of the trade of the country.

Resources and Occupations. Northern Thailand consists of ranges of mountains running from north to south. The highest peak is Doi Angka, 8,452 feet high. Eastern Thailand is on the Khorat plateau which slopes from the mountains to the Mekong River. This river forms a great part of the border between Thailand and Laos. Central Thailand is the valley of the Chao Phraya, the main river of the nation. Thailand in the Malay peninsula is jungle.

The people are mostly farmers. Rice, rubber, and tin are the most important products and exports of the country. Coconuts, tobacco, sugar cane, pepper, and cotton are grown. Livestock raising, including elephants and water buffalo, is important in northern and eastern Thailand. Thailand's thick forests yield teak, shellac, gutta percha, and bamboo. Tin, tungsten, lead, antimony, and lignite are mined. Manufacturing includes rice and sugar milling, and the making of rubber goods, textiles, tobacco products, lumber and paper products. Loans from the International Bank for Reconstruction and Development and from the United States have been used to increase electric power facilities and roads, and for agricultural development.

Government and History. Thailand has been a constitutional monarchy since 1932. It has had legislatures, partly appointed and partly elected, but the real power since World War II has been held by various strong men who have risen to power.

The Khmers, most of whom now live in Cambodia, were the first invaders of the region 3,000 years ago. The Lao-Thai had established themselves by 600 A.D. Their great empire was overthrown by Kublai Khan in the 1200's. In the 1800's, Thailand alone in southern Asia maintained its independence of European nations. Thailand is a member of the United Nations and its capital, Bangkok, is headquarters of the Southeast Asia Treaty Organization.

THAL'LIUM. This metal was first discovered in 1861 by Sir William Crookes. It is similar to lead, is very soft, and is easily drawn into wire.

Thallium compounds are poisonous. Thallous sulfate is used as an insecticide and for destroying gophers, rats, and other small animal pests. Thallium bromiodide crystals, which are sensitive to infrared rays, are used as devices for signaling in the dark. Lead alloyed with thallium is highly resistant to corrosion and is plated on metal parts for chemical machinery; and a liquid alloy of thallium and mercury is used in low-temperature thermometers. Thallium's symbol is *Tl*.

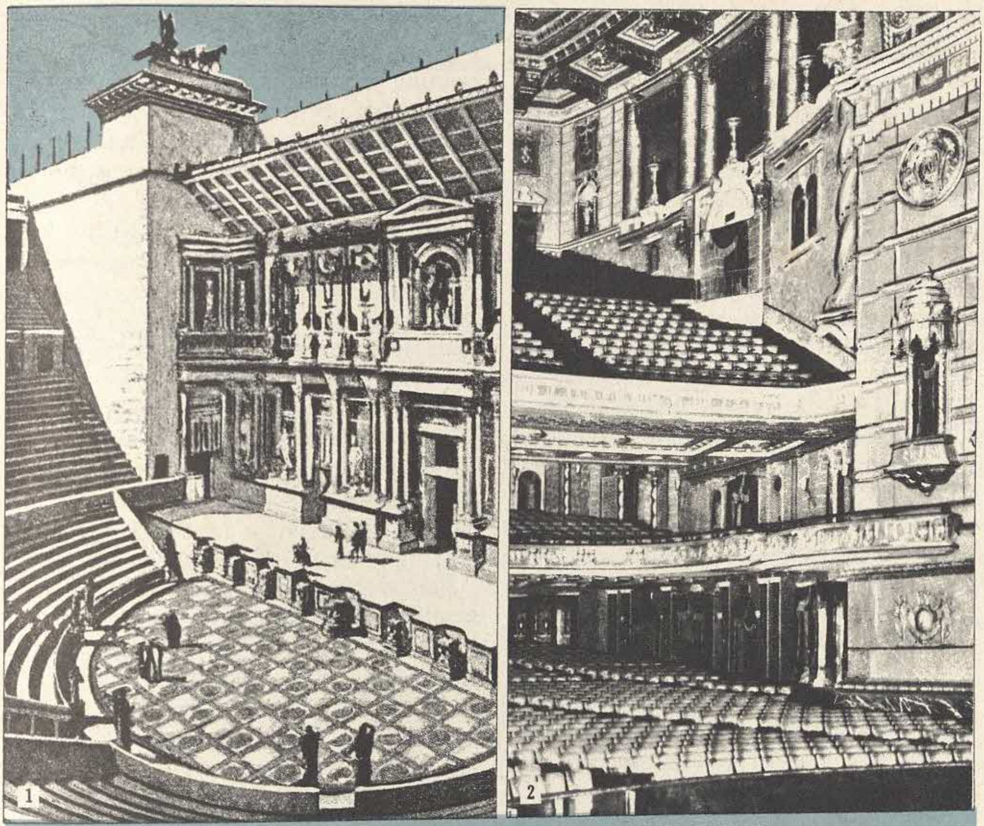
THALLOPHYTES, *thal' o fites.* The lowest branch of the plant world consists of plants called thallophytes. See BOTANY.

THAMES, *temz.* Flowing eastward from its source in Gloucestershire, the Thames, 215 miles in length, is England's most important river. In its course the river forms the boundary of the counties of Berks, Surrey, and Kent on the south and of Oxford, Buckingham, Middlesex, and Essex on the north. Leading cities on its banks are London, Oxford, Reading, Windsor, Abington, and Kingston. About forty miles below London, the Thames enters the North Sea through an estuary eighteen miles wide. Navigable for 200 miles for light craft and barges, the river will permit the passage of the largest ocean vessels as far as London, where great docks are maintained. The Thames serves a wide area through its elaborate canal system that covers the Midlands.

THANKSGIVING DAY. When the Pilgrim Fathers settled in Massachusetts they experienced a severe winter. When spring came they planted and cared for their crops so that ample food might be available for the next winter. The harvest proved bountiful. Being religious people, they set aside a day for thanksgiving for the harvest. Therefore, each year after the harvest we celebrate Thanksgiving.

Each year the President of the United States, beginning with Lincoln, has issued a proclamation setting aside a Thursday in November as Thanksgiving Day. The last Thursday was chosen until 1939, when Franklin D. Roosevelt, to aid business, set the date of observance a week earlier. This happened twice more until, in late 1941, Congress passed a law making the fourth Thursday the legal holiday.

THE'ATER. To many people, the theater is merely a building where plays, moving pictures, and operas are performed for the amusement of the public and the profit of managers, producers, actors, and real-estate operators. The real theater, however, is more than the physical plant where performances take place. It embraces more than a stage, an orchestra pit, scenery, seats, and a box office. It is the expression of the spirit of a community, which cannot



THEATERS OF ANCIENT AND MODERN TIMES

(1) In Ostia, seaport of Rome, are the ruins of an open-air theater. As shown in the reconstruction, the seats, rising from the mosaic pavement of the orchestra, were separated into two main divisions, and awnings were suspended overhead to protect the audience from the blazing sun. (2) The spacious Roxy Theater in New York City.

be portrayed in any other way. It represents the combined efforts of the dramatist, the actor, and the spectator in the enjoyment of an artistic presentation of some form of the drama. The theater of the Greeks was a necessary part of the life of a citizen of Athens, and the theater of Elizabethan England was a sincere expression of the people and life of that day and age.

In Athens it was the duty of the aristocracy to finance the theater; and it was the duty of the state, in the time of Pericles, to pay admissions of the poorer classes, in order that they might witness the tragedies and comedies of the great dramatists. Greek drama was performed in an open-air theater in the daytime. The theater was constructed so that the seats were built in a semi-circle on a hillside, enabling spectators to see the performance easily. The action took place in the orchestra, a circle at the foot of the rows of seats.

The chorus performed in the front of the orchestra, nearest the spectators. The back part of the orchestra was a raised platform, where the actors performed. We still use the term *orchestra* to mean the part of a theater just in front of the stage. In the Greek theater no scenery was used, the *skene,* or high structure of the stage building, supplying the only background. Our word *scenery* comes from *skene.* Greek actors wore high-soled shoes, called *buskins,* when they were portraying tragic characters, because such shoes gave them height. Greek performers also wore masks, which had megaphones attached to carry their voices to all parts of the theater.

A smaller structure than the big theater used for the drama was the *odeum*. It was a roofed building used for musical performances and competitions.

Rome, as she did in other branches of culture, copied the Greek theater and made some changes. Roman theaters were built on level ground, the sloping tiers of seats being made possible by the use of arches. Since the Romans seldom employed the chorus, the orchestra was built in the form of a semicircle, and important people had seats there. All the action of the drama took place on the stage. The great Roman theaters were open-air structures, although the Romans, as had the Greeks, also built odea with roofs.

The Roman theater finally degenerated to such an extent that, after the fall of the empire, the theater practically disappeared. The miracle plays and the morality plays of the Middle Ages were not performed in theaters, but in public squares and churches.

The theater was revived, however, during the reign of the English Tudors; and in 1576 James Burbage built the first playhouse erected in England. It was located at Shoreditch, a section of London. This theater had a bare stage, a pit where the common people stood, and balconies where the upper classes sat. It hardly compared with our modern structures, but what a popular theater it was! More like it were built, and one authority estimates that the London theaters had an attendance of 400,000 every month, and that in a city of only 300,000 population.

When the theaters were closed by the Reformists, the English stage declined, only to revive as a place for amusement. In the nineteenth century, it again became an art. In other lands it developed along different lines. Italy originated movable scenery and modern stage devices; Spain was the home of a vital and vigorous, but unadorned, theater; France developed the state theater, which sponsored satire and political criticism and encouraged the training of great actors and actresses; Germany tried to found a national theater before it was a nation; and the Moscow Art Theater in Russia influenced the entire world.

In the United States great strides have been made along technical lines, but in the twentieth century much of the real art of the theater almost disappeared. The Little Theater movement, and such organizations as the Provincetown Players, the Theater Guild, and the former Federal Theater are rebuilding the theater which has suffered as an art at the hands of syndicates of producers and real-estate operators, and as entertainment from the inroads of moving pictures and radio.

For further information, consult the following articles:

- Amphitheater
- Comedy
- Drama
- Masque
- Miracle Play
- Morality Plays
- Moving Pictures
- Mystery
- Opera
- Passion Play
- Radio
- Tragedy

THEBES, *theebz,* EGYPT. Long the most magnificent city of ancient Egypt was Thebes, the capital and seat of the government of the Pharaohs. Founded in prehistoric times, it was located on both banks of the Nile about 480 miles southeast of Cairo. Thebes reached the height of its splendor about 1300 B.C. A few small villages stand on the site, and in the vicinity are some of the most famous ruins of ancient Egypt. Extending up and down both sides of the river, they comprise massive temples, the great tombs of the ancient rulers, finely carved obelisks, and gigantic statues. The most important ruins are relics of ancient Karnak and Luxor (see LUXOR). Near by lies the recently excavated tomb of King Tutankhamen. See ARCHAEOLOGY.

THEBES, GREECE. Located about forty miles northwest of Athens was Thebes, once the most powerful city of ancient Greece. On its site is the unimportant town of Thiva, with about 12,500 inhabitants. The old city, thought to have been founded by Cadmus more than a thousand years before the Christian Era, reached the height of its power with the victories of Epaminondas over the Spartans in 371 B. C., and remained the foremost city until his death in 362 B. C. Crushed first by Philip of Macedon in 338 B. C., Thebes made a desperate attempt to regain its independence against Alexander the Great, but the city fell and all the inhabitants were sold into slavery (335 B. C.). The city prospered somewhat under the rule of the Romans, but dwindled under the Turks.

THEMISTOCLES, *the mis' toh kleez* (about 514-449 B. C.). One of the great men of early Greece was Themistocles, an Athenian general and statesman who paved the way for Grecian supremacy over Persia by his creation of a strong Athenian navy. Made archon of Athens in 481 B. C., he became convinced that the Persian invasions were not at an end and that the country needed a naval fleet to protect its borders. Themistocles therefore induced the Greeks to build a large navy, and when the Persians invaded the country, he was the real leader of the sea forces, although he did not hold the title of commander. In the naval Battle of Salamis, in 480 B. C., the Greeks gained a decisive victory and Themistocles became the hero of a grateful country. His popularity waned, however, and a few years later he was exiled by a vote of ostracism. He retired to Argos and finally went to the court of Artaxerxes, king of Persia, where he remained until his death. See ATHENS.

THEODORIC, *the od' o rik,* surnamed THE GREAT (about 454-526). Founder and first king of the Ostrogothic kingdom in Italy, Theodoric the Great was a wise and just ruler. He was born in Pannonia, the son of a king of the Ostrogoths. From his eighth to his eighteenth year, Theodoric was held at Constantinople as a hostage. Upon the death of his father, in 474, he became the leader of the Ostrogoths. In 488 Theodoric invaded Italy, where the barbarian Odoacer had set up his kingdom after the fall of Rome. He fought him for over four years and in 493 murdered him.

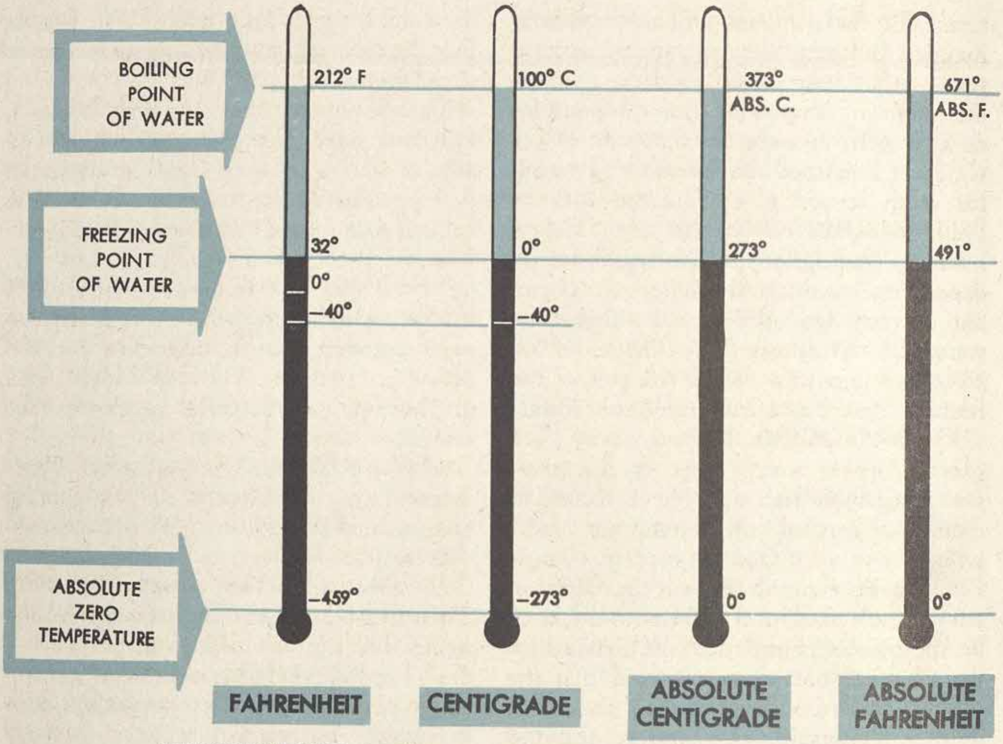
Theodoric was now supreme in Italy. His reign was marked by an enlightened administration of justice and the economic development of his kingdom. Theodoric himself was tolerant in matters of religion. Toward the close of his reign, however, he had Pope John imprisoned because of his failure to secure from the Eastern Roman emperor, Justin, tolerance for the persecuted Arians. Theodoric was buried in Ravenna, his imperial residence. See GOTHS.

THEODOSIUS, *the o doh' she us.* Three emperors of the Eastern Roman Empire were named Theodosius. Two are of historic importance.

Theodosius I, The Great (346?-395). This greatest of the emperors to bear the name was the son of a famous general, the Theodosius who served under the Emperor Valentinian I. Theodosius was born in Spain. He gained valuable military experience under his father, and in 379, at the request of Gratian, ruler of the Western Empire, he took over the eastern provinces. Theodosius thus became emperor of the East. During the next few years he successfully repelled several invasions of the Goths.

In 383 Gratian was defeated and murdered by Maximus, and Theodosius was compelled to acknowledge the latter as ruler of Britain, Gaul, and Spain. Gratian's younger brother, Valentinian II, had been given Italy, Africa, and Illyricum as his share of the empire. When Maximus, in 387, invaded Italy and expelled him, Theodosius attacked and defeated the usurper and restored Valentinian in 388. In 392 the youthful emperor of the West was slain, and Theodosius again invaded Italy, eventually defeating the murderers.

At his death his son Arcadius became emperor of the East, and Honorius, another son, emperor of the West. Never again was the Roman Empire united under one ruler. Theodosius did much to



TEMPERATURE SCALES — COMMON AND UNCOMMON
The Absolute Centigrade and the Absolute Fahrenheit scales are familiar only to scientists.

strengthen Christianity, and he was unrelenting in his opposition to Arianism, an unorthodox form of Christianity.

Theodosius II (401-450). The son and successor of Arcadius, Theodosius II succeeded to the throne of the Eastern Empire in 408. Theodosius' reign was marked by a war with Persia and costly invasions of the empire by the Huns under Attila. The religious Council of Ephesus was summoned by Theodosius in 431.

THERMOELECTRICITY, *thur mo e lek tris′ i ti.* When two or more unlike metals are joined in a closed circuit and one of the junctions is heated or cooled, a small electric current will be produced; the process is called *thermoelectricity,* a term meaning *heat electricity.* If iron and German silver wires are used and their loose ends are attached to a galvanometer, the current registered is minute; if antimony and bismuth are substituted, the flow of current will be stronger. Metals of considerable electromotive force give the best thermoelectric results; bismuth and antimony are generally used.

Scientists use a series of thermo-electric junctions, or *thermocouples,* in conducting delicate experiments in radiant heat; this apparatus consists of little piles of antimony and bismuth bars (or two other metals) closely intermeshed, the opposite ends being connected to a galvanometer. The device is so sensitive that it can measure the heat of stars; it is often used to register temperatures in the heat treatment of metals.

THERMOGRAPH, *thur′ mo graf.* A self-recording thermometer, the thermograph is a device used for keeping a permanent and continuous record of temperature. In the common thermograph the record is made on a circular paper disc, divided into hour and minute spaces and marked with closely spaced concentric circles which indicate degrees of temperature. The disc is moved by clockwork and makes a complete turn once each twenty-four hours. A needle, attached to a special thermometer, moves as the temperature rises or falls, and inscribes on the disc a wavering line in ink, showing the temperature at any given time. See THERMOMETER.

THERMOM'ETER. Although the thermometer may take many different forms, it has but one purpose—the measuring of temperature. One of the earliest thermometers was that devised by Galileo about 1593. Not until about a century later did the centigrade and Fahrenheit thermometers, so commonly used today, appear. The centigrade is especially used by scientists; the Fahrenheit thermometer is generally employed for temperature readings of the weather.

The most common form of thermometer is a slender glass tube filled with mercury. At the bottom of the tube is a bulb, which is heated until the column of mercury rises to the top. The tube is then sealed, and as the liquid cools and contracts, a vacuum is created at the upper end. The tube is then fastened to a wood or metal support on which is marked a scale to indicate temperature according to the height of the mercury column.

In one of our everyday thermometers, the mercury stands opposite the mark *32* if (with normal atmospheric pressure) it is placed in melting ice, and opposite *212* if it is in boiling water. On a scientific thermometer, melting ice brings the mercury to *zero* and boiling water lifts it to the mark *100*. The difference is, of course, simply in the way the thermometers are marked. The common thermometer is marked according to the Fahrenheit scale, in which there are 180 equal divisions, or degrees, between the freezing and boiling points of water. The scientific thermometer bears the centigrade scale and has 100 degrees in the same range. The scale is usually extended above the boiling point and below the freezing point.

Because of its extremely low freezing point, alcohol is placed in thermometers used for registering temperatures far below the freezing point of mercury.

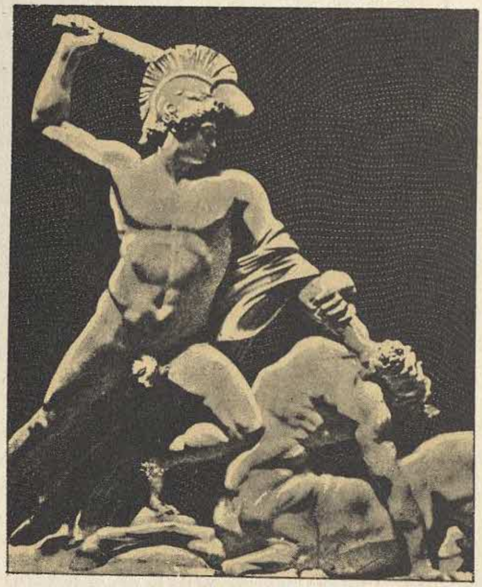
Very often it becomes necessary to change centigrade readings to Fahrenheit, and vice versa. To change Fahrenheit to centigrade, subtract 32° and multiply by 5/9. To change centigrade to Fahrenheit, multiply the centigrade reading by 1.8 and add 32°.

THERMOPYLAE, *thur mop' il e.* Memorable as the scene of a heroic Spartan stand against the Persians, Thermopylae was a narrow pass between Mount Oeta and the Malic Gulf. It was the only gateway to Central Greece from the north. In 480 B.C. a huge Persian army under Xerxes invaded Greece. Defending the pass was Leonidas, king of Sparta, with 300 Spartan soldiers and a few thousand other Greeks. Xerxes struggled to force his way through, but the pass was stoutly held. Then, after three days of battle, a traitor led the Persians over a path in the mountains, and the enemy attacked from the rear. Although they could have retreated, Leonidas and his little band of Spartans, with many of their allies, fought to the last man. See GREECE.

THERMOSTAT, *thur' mo stat.* Modern heating systems are usually regulated by a thermostat, an automatic device which responds to changes of temperature. The thermostat acts on the principle of the expansion and contraction of metals or liquids due to the variations of temperature. When temperature rises the thermostat expands; and, at a point which can be adjusted to any temperature desired, it operates, by means of levers, clockwork, or otherwise, one or more dampers which check the fire or allow surplus heat to escape. As the temperature falls the process is one of contraction, and when it passes the desired point, the dampers are reversed and the fire is stimulated or more heat is retained. See HEATING AND VENTILATION.

THESE'UM. In ancient Greece, any temple dedicated to Theseus, the legendary king of Athens, was called a Theseum.

The most famous of such temples was located north of the Acropolis in Athens, and was erected about 470 B.C. No trace of this building remains today. Another Athenian temple, probably the best preserved of all Greek temples, is commonly called a "Theseum," although it is thought to have been dedicated to Hephaestus. It is located northwest of the Acropolis, near the *agora,* or market place. Doric in style and built of Pen'telic marble, this temple has thirteen pillars to a side and six similar columns across the front and the back. The frieze consists of scenes from the adventures of Theseus and Hercules.



HEROIC SON OF AEGEUS
Slaying of a centaur by Theseus of Athens.

THESEUS, *the' se us,* or *the' suse.* The central figure in many of the most famous of Greek legends, Theseus, a mythical king of Athens, was the son of Aegeus and Aethra. Reared in seclusion by his mother, Theseus came to Athens while a young man and was acclaimed as heir to the throne.

The best known of all legends of Theseus is the story of the killing of the great Minotaur. As a result of a defeat in war, Athens was required to send seven maidens and seven youths to be sacrificed to this beast, which lived in a great labyrinth in Crete. Theseus sailed for Crete, killed the monster with the aid of the Cretan princess Ariadne, and returned to Athens. Because he forgot to hoist a white sail as a signal of his success, Theseus' father threw himself into the sea, which was thereafter known as the Aegean Sea.

When Theseus became king, he ruled wisely and well, accomplishing much for the state principally in the consolidation of the twelve kingdoms of Attica. Theseus, according to legend, also warred on the Amazonian women, whose leader, Antiope, he captured. He is also thought to have gone with Jason in search for the Golden Fleece and to have joined in the attempt to rescue Proserpine from the underworld. Upon his return he found his kingdom in revolt. Unable to quell it, he went to the island of Scyros, where he was put to death.

THESSALO'NIANS, EPISTLES TO THE. Comprising two books of the New Testament of the Bible, the *Epistles to the Thessalonians* were written by Saint Paul to the members of the Church at Thessalonica, which the apostle had founded. In the letters Paul gave spiritual encouragement to the people and explained the doctrine of the resurrection.

THES'SALY. In the northeastern part of Greece is Thessaly, a fertile plain 5,000 square miles in area, enclosed by short mountain chains. Thessaly comprises two political divisions or departments of the Greek state—Larissa and Trikkala—and has a total population of about 630,000. Larissa is the principal city, and from the port of Volo goods can be shipped to Athens. In Thessaly, which is drained by the Salambria (or Peneus) River, lie Mount Olympus and mounts Pelion and Ossa.

In the early history of Greece, the area was inhabited by Aeolic and other tribes which broke up into several small confederacies. Never important in the course of Greek history, Thessaly fell before Philip of Macedon in the fourth century

GUSTAVUS ADOLPHUS SEEKS HEAVENLY AID AT LUTZEN

Though victorious in the battle which followed this supplication, the ambitious Swedish king was slain. Following his death, Sweden's attention was drawn to internal affairs.

B. C. and remained under Macedonian control until the Battle of Cynoscephalae in 197 B. C., when the area passed under Roman authority. In 1355 the Turks seized Thessaly, holding it until the Congress of Berlin in 1881, when the area was awarded to Greece.

THIRST, *thurst.* As the normal water content of the body tissues is decreased, the remaining liquids become more saline (salty), and we feel the sensation of thirst, particularly in the mucous membranes surrounding the pharynx. Tissues lose water as a result of certain diseases, highly seasoned foods, perspiration, and normal body excretions. That the loss of water from the tissues is widespread throughout the body has been demonstrated by the fact that thirst may be relieved, not only by drinking water, but also by injecting fluids into the veins or by absorbing them directly through the skin. Water forms nearly three fourths of the body weight. Six to eight glasses of water a day are said to be necessary to maintain this balance.

THIRTY YEARS' WAR. Religious differences between the German Catholics and Protestants brought on the Thirty Years' War (1618-1648), which also involved territorial and political issues. In general, the conflict represented an effort on the part of the Protestant countries of the Netherlands, Sweden, and Denmark, Protestant German states, and Catholic France to check the power of the Holy Roman Empire. In the year 1609 Protestant warriors were allied in the Protestant, or Evangelical, Union, and Catholics in the Catholic League.

The Reformation had not only weakened the empire but had encouraged the states in their desire for self-government. Catholics and Protestants could find no common point of compromise, especially after the Peace of Augsburg (1555) failed to establish a permanent peace. The war was marked by four phases.

Bohemian-Palatinate War (1618-1624). The first phase of the war began in Bohemia as a result of the opposition of the nobles to the accession of the Catholic Ferdinand II to the throne. Protestant forces deposed the king and declared Frederick, elector of the Palatinate, king. Ferdinand crushed the rebellion, but his ruthlessness aroused Protestants over all Europe.

Danish-Saxon War (1624-1630). In 1625 King Christian of Denmark, supported by the English and Dutch Protestants, championed the cause of the German Protestants. He fought against the Catholic forces, led by Tilly and Wallenstein, but was severely defeated; this phase of the war was concluded by the Peace of Lübeck.

Swedish-German War (1630-1636). Because of his Protestantism and the necessity of protecting Sweden from the ambitious designs of Ferdinand (now Holy Roman Emperor), Gustavus Adolphus entered the war in 1630. Meeting Tilly in battle at Lützen, the Swedish king defeated him but was himself killed. The Swedish forces continued to fight but lost the Battle of Nördlingen, and the Catholic emperor's power in Germany was restored.

French-Swedish War (1636-1645). The desire of France to cripple Austria politically led to her participation in the last phase of the war. The combined forces of France and Sweden won a series of important victories which brought them to the gates of Vienna. However, by 1645 all Europe was tired of war, and the nations began negotiating for a general peace.

The Peace Treaty. In 1648 the Treaty of Westphalia was concluded and the long war ended. It had brought about the virtual collapse of the Holy Roman Empire and considerably weakened the power of the Hapsburgs in European affairs. The individual states of the empire became partially self-governing, and both the Netherlands and Switzerland were given complete independence. Most important, the war resulted in the economic and commercial ruin of Germany and retarded her political development for more than a hundred years. In addition, the population of Germany was reduced by half, the wealth by two thirds. Religion, morality, and education were brought to a low ebb as a result of the conflicts.

For additional information, consult the following articles:

Germany
Gustavus II
Reformation, The
Tilly, Johann
Wallenstein, Albrecht

EMBLEM OF RUGGED SCOTLAND
But a pest on the farm is the bull thistle.

THISTLE, *this' 'l.* The blossom of the prickly, spiny plant which we know as the thistle has long been the national flower of Scotland. Thistles have coarse, heavy leaves and sharp spines, and are disseminated by creeping roots and wind-borne seeds. They belong to the very large composite family of plants.

There are about a dozen species scattered over the United States. Best known of these are the *bull* thistle, also called the *Scotch* thistle, and the *Canada* thistle. The latter is a troublesome weed throughout the northern half of the United States. See CANADA THISTLE.

THOMAS A KEMPIS (about 1380-1471). A celebrated medieval religious figure, Thomas à Kempis is best remembered as the author of the famous spiritual work, *The Imitation of Christ.* He also produced a large number of essays, biographies, sermons, and religious treatises, but it is almost entirely because of his great book that his name has survived. Born at Kempen in the Rhine Valley, Thomas à Kempis (Thomas of Kempen) spent most of his life in an Augustinian monastery near Zwolle, Holland, which he entered at the age of twenty. Twenty-five years later he became the subprior. His family name was Hammerken.

THOR, SLAYER OF GIANTS
None but he could wield his massive hammer.

THOR. A strong and gigantic figure who carried a great hammer as the symbol of his authority, Thor was the most important and powerful god of Norse legend. The god of thunder, war, and might, and the patron god of the peasants, Thor was the son of Odin and Frigga and the husband of Sif, the Delighter. Thunder was supposed to be caused by the rumble of his chariot wheels. His great hot hammer, made for him by the dwarfs, returned to his hand after being hurled, and was the god's sole weapon in his incessant wars against the giants.

The best-known legends in which Thor figures include his heroic conflicts with the giants and the fatal contest in which Thor was killed by the venomous breath of the serpent of Midgard. Thor, in whose honor Thursday is named, was widely worshiped in the Scandinavian countries, and many temples were erected to him. See MYTHOLOGY.

THOR'AX. See SKELETON.

THOR'IUM. A metallic element found in such minerals as orangite, thorite, and monazite, thorium was discovered in 1828 by Berzelius, a Swedish chemist. The symbol for thorium is *Th*. This grayish metal has a density of 11.5 and a melting point of 1,845°C. Thorium never occurs in the free state, but is found in a number of compounds. Thorium is radioactive. Thorium oxide is used in the manufacture of the Welsbach gas mantle.

THORWALDSEN, *tore' wauld sen,* BERTEL (1770-1844). Denmark's leading sculptor, Bertel Thorwaldsen was the foremost modern exponent of the style and spirit of classic Grecian sculpture. Thorwaldsen's characterizations of mythological and historical subjects are famous the world over. Among his works are *Jason with the Golden Fleece, Entry of Alexander the Great into Babylon, Psyche,* and *The Lion of Lucerne,* the last a memorial to the Swiss Guards who perished in the French Revolution.

Born in Copenhagen of Icelandic parentage, Thorwaldsen began studying at the age of eleven, and in 1797 was sent to Rome, where his work came under the influence of Canova. He was later elected to the Accademia di San Luca. Others among Thorwaldsen's outstanding pieces of sculpture are *Memorial to Baroness Schubart, Cupid and Psyche, Morning, Night,* and *The Four Seasons.*

THORWALDSEN'S BUST OF NAPOLEON
Known the world over is his *Lion of Lucerne.*

THOUSAND ISLANDS. Throughout the entire course of the Saint Lawrence River there is not a more delightful spot than the Thousand Islands, including something like 1,500 islands lying just below Lake Ontario. At this point the river varies from four to ten miles in width, and the islands, ranging from mere points of rock to areas of several acres, extend a distance of forty miles. With their delightful summer climate, it is little wonder that these oft-times precipitous, tree-clad islands have come to be a favorite playground for vacationers. Many of the islands are privately owned and are the sites of beautiful homes.

THRACE. This name was applied by the ancient Greeks to a region lying in the eastern part of the Balkan Peninsula and extending from the Danube southward to the Aegean Sea and the Sea of Marmora. Thrace comprised the area now occupied by Bulgaria, European Turkey, Northeastern Greece, and part of Rumania. A fertile land with rich mines, the country was a valuable colony, first conquered by the Persians and later by Philip of Macedon, about 359 B. C. Thrace became a Roman colony in 133 B. C. The chief river of old Thrace was the Hebrus, now known as the Maritsa. Flourishing cities of Thrace included Abdera, Byzantium, located on the site of Istanbul (Constantinople), and Sestos, on the historic Hellespont.

THRASH'ING MACHINE, or THRESH'ING MACHINE. Until about 1850 grain in the United States was usually threshed with flails or threshing sleds. It was a full day's work for one man to thresh and clean seven bushels of wheat, eighteen of oats, or fifteen of barley. But a successful threshing machine had been invented in 1786 by Andrew Meikle in Scotland, and in 1837 an improved machine was invented by Hiram and John Pitts of Maine. Since then, many other improvements have been made to produce the efficient modern threshing machine. The threshing machine has reduced the drudgery of grain farming and the cost of grain products, and it has helped to make it practicable to farm areas like the western plains of the United States. Hence the threshing machine has increased grain production and contributed to the food supply of the world.

Four distinct operations are performed by a modern thrashing machine. They are: (1) shelling or thrashing of the grain; (2) the separation of the straw from the grain and chaff; (3) the separation of the chaff from the grain; (4) delivery of the grain to one place and the straw and the chaff to another.

The first operation is performed by the *cylinder* and *concave*. The cylinder is made up of heavy bars attached to discs, in which the cylinder teeth are fastened with threaded or keyed ends. As the cylinder revolves, its teeth pass between rows of teeth in a stationary position, set into bars or plates; the latter constitute the concave. The grain is thrashed while being fed through these teeth.

Back of the cylinder is placed the *grate*, consisting of parallel bars with open spaces between. Just over the grate the *beater* is placed to form the straw into a stream as it comes from the cylinder and passes to the *straw rack* and thence to the *stacker*. The straw rack is made up of vibrating fingers which shake the straw thoroughly and allow the grain and chaff to pass through to the *grain pan* underneath. This latter is a solid floor extending from the cylinder to the sieves of a framework called the *shoe*. The grain passes through the sieves, while the chaff is either carried over the sieves or blown out from underneath by a blast of air from a fan. In most cases the straw is delivered from the machine by a *wind stacker*, arranged in an arc of a circle.

The grain, after passing into the *recleaner* for removal of undesirable material such as weed seeds, is conveyed to the automatic *weigher*, which weighs the grain as thrashed before it is dumped into wagons or bags. The largest machines, run by steam or gasoline power, can thrash from 1,200 to 1,500 bushels a day.

The Combine. This is a combination of reaper and thrasher. Drawn by large tractors, the combine cuts and thrashes the grain in one operation, blowing the straw about on the ground to serve as a fertilizer. A wagon is usually driven alongside through the field, catching the grain as it comes from the weigher. The huge wheat crop of the Grain Belt is bagged on a combine grain platform, piled into wagons, and delivered to local elevators for shipment.

THE WARY HERMIT THRUSH
Happy habitant of moist, pine-clad valleys.

THRUSH. Well known are the thrushes, thought by many bird lovers to be the finest of feathered songsters. The familiar robin and bluebird are thrushes, but the name is usually applied to the more quiet-colored members of the family, birds of various shades of olive and brown, with more or less spotted breasts. The North American thrushes are of medium size, six to ten inches in length. They inhabit woodlands, some of them the open country as well, even near human habitations, and are often seen on the ground.

Most thrushes spend the winter in the Southern states, Mexico, or farther south. The better-known species, aside from the robin and bluebird, are the *wood* thrush, rich brown in color with large, round black spots on a white breast; the *veery,* or *Wilson,* thrush, somewhat smaller, with very faint breast markings; the *hermit* thrush, a notable singer, with tail much brighter and redder than the back; the *olive-backed* thrush; and the *varied* thrush, which looks more like a robin than a thrush. See BLUEBIRD; ROBIN.

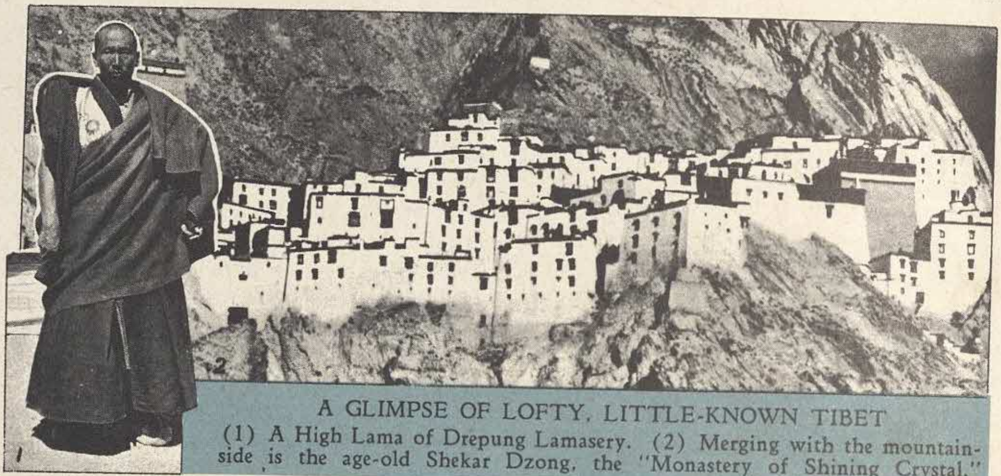
THUCYDIDES, *thu sid' i deez* (about 460-about 399 B. C.). Among the immortal Greek historians was Thucydides, whose fame rests on his monumental *History of the Peloponnesian War.* Accuracy and impartiality are characteristic of his chronicles of the war, and particularly notable are his fine descriptive passages and his analyses of the motives which prompted leading figures in the war to enter the conflict and which accounted for their actions during the campaigns. The style of Thucydides is terse to the point of obscurity in some instances. The history covers the period from 431 to 411 B. C., twenty-one of the twenty-eight years of the war, and consists of eight books.

Thucydides was born in Attica of wealthy and noble Thracian parentage. The historian served as a naval commander in the war he later chronicled, but was exiled from Greece for a period of twenty years for his failure to raise the siege of Amphipolis. He began collecting data for his history in 431 B. C. because he appreciated the great importance of the war.

THULIUM, *thu'li um.* One of the rare earth metals is an element found in Scandinavia; hence its name, from *Thule,* the Latin for *far north.* It is extremely difficult to separate this element from the compounds in which it occurs in nature. The characteristic color of thulium compounds is light green. The chemical symbol of the element is *Tm.*

THURSDAY, *thurz'day.* The fifth day of our week is Thursday. It is named for Thor, the god of thunder in Norse mythology. Important days falling on Thursday are Thanksgiving, observed in the United States as a legal holiday (since 1941) on the fourth Thursday in November; and Maundy Thursday, or Holy Thursday, observed the day before Good Friday.

TI'BER. Italy's second largest river, the Tiber has been associated with the history of Rome from earliest times. It rises in the Apennines of Tuscany, and follows a twisting southward course for about 245 miles to the Tyrrhenian Sea. It enters the sea



A GLIMPSE OF LOFTY, LITTLE-KNOWN TIBET

(1) A High Lama of Drepung Lamasery. (2) Merging with the mountainside is the age-old Shekar Dzong, the "Monastery of Shining Crystal."

twenty-six miles from Rome, through which it flows. The divided mouth of the Tiber is choked by a huge delta of yellow sand and mud, and the river itself has a yellowish color. The Tiber has caused disastrous floods in the city area of Rome, and great levees for flood control have been constructed. The river is navigable for about 100 miles, although boats seldom ply above Rome.

TIBE'RIUS (42 B. C.-A. D. 37). The second emperor of Rome, Tiberius succeeded Augustus in A. D. 14. He was the son of Tiberius Claudius Nero. His mother was the second wife of Augustus, who adopted him as his heir. Tiberius early showed great ability. He became a consul in 14 B. C., and his services in the wars against the German tribes won him a triumph at Rome in A. D. 11. He was a strong ruler, but lost popularity because he practiced economy in government and decreased expenditures for public shows and amusements. In the interests of efficiency, he refused to let the masses go through the form of voting, and he made no attempt to conceal his contempt for the Senate. His rule of the provinces was wise and just.

The emperor's personal life was full of sorrow and disappointment, and he spent his last years in retirement on the beautiful island of Capri, in the Bay of Naples. Tiberius was succeeded by Caligula, his adopted son.

TIBET, *tib et'*. The lofty wind-swept stretch of Central Asia that is Tibet many be considered a part of Outer China. With its area of 400,000 square miles, it comprises the world's most extensive system of plateaus. Hemmed in on three sides by mountains, including the towering Himalayas to the south, Tibet lies at an altitude varying from 14,000 to 17,000 feet. Thus it is in truth "the roof of the world." Few countries are so little known to Western nations as is Tibet. The country is the home of Lamaism, a peculiar form of Buddhism.

The climate of Tibet is noted for its great extremes of heat and cold. The western portion of the country, robbed of rainfall by the mountains, is largely desert; while the southeastern section, where most of the inhabitants live, is well watered by the Brahmaputra River. Here, the natives cultivate such crops as wheat, barley, potatoes, turnips, pulse, and fruit. Sheep and yaks are the only livestock of importance. The flocks, as in Switzerland, are driven to the slopes for grazing during the summers, and return to the valleys with the approach of winter. Interesting among the wild animals of the Himalaya Mountains are the giant and lesser pandas (see PANDA).

Manufacturing can hardly be called an industry in Tibet, though metal working, pottery making, and the embroidering of silks are carried on. The natives make their own clothing from a heavy, homespun wool serge. In winter they also wear sheepskins. There are large timbered areas in the sheltered valleys of the east and southeast. Gold, coal, silver, iron, niter, salt, and borax are found. The chief minerals worked are gold, borax, and salt. Across the lofty mountain passes, sheep and yaks carry local products to India.

Tibetans are Mongolians with an Indian strain. Some of them practice polygamy. The population is about 1,300,000.

China has claimed Tibet since the 1700's, but the rival Lamas, the Dalai Lama and the Panchen Lama, were the real political rulers of their followers. In the 1920's, the Panchen Lama fled to China, and the Dalai Lama ruled Tibet. Upon invasion in 1950 by the Chinese Communists, Tibet signed a treaty that acknowledged it to be part of China. The Communists attempted to communize the region in 1956. The Tibetans revolted. In 1959, Chinese troops moved into Tibet, and also occupied 51,000 square miles of Indian-claimed territory on the border of India and Tibet. The Dalai Lama fled to India, and the Panchen Lama was made head of Tibet by the Communists. Thousands of Tibetans became refugees in India.

TICKS. Among the injurious parasites that attack man and animals are the ticks. With mites and spiders, they belong to the class *Arachnida*. Ticks are not insects, although they bear some resemblance to them. They have oval-shaped bodies and four pairs of legs, and are larger than their close relatives, the mites (see MITES). Ticks bite into the flesh of their victims and suck their blood.

Very annoying, although not the most dangerous species, is the common *wood* tick, which lives in the damp woods of Canada and the United States. It attacks both man and animals, and unless noticed before it has gorged itself with blood, is difficult to remove. If gasoline or kerosene is at once applied, the parasite will loosen its hold and can be pulled out easily. The *cattle* tick of the South and the *spotted fever* tick of Montana both carry disease germs that sometimes bring fatal results.

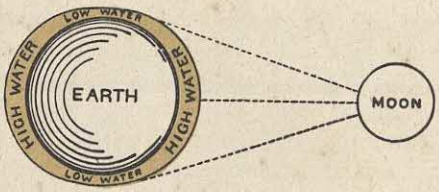
TICONDEROGA, *ty kon dur o'ga.* As the key to the natural highway between Canada and the United States, Ticonderoga held an important position in the colonial history of America. Located in New York state about eighty-five miles north of Albany, it controlled the route through Lake George and Lake Champlain, and was the site of battles in three wars.

In 1609 the importance of Ticonderoga for military purposes was first noticed when Champlain won a victory over the Mohawk Indians, allies of the British. In 1755 the French fortified the place, and three years later, during the French and Indian War, Montcalm held it against the British led by General Abercromby. The following year, however, it fell to the British under General Amherst.

When the Revolutionary War broke out, Ticonderoga immediately became an objective of the colonial troops. In May, 1775, the fortress was captured for the Americans by Ethan Allen and his Green Mountain Boys, and by troops under Benedict Arnold (see ALLEN, ETHAN). The Americans were unable to hold their position, however, and two years later, Fort Ticonderoga was taken by the British under Burgoyne. After Burgoyne's surrender at Saratoga, Ticonderoga no longer was important, and the fort was abandoned. The ruins may still be seen near the present village, center of the graphite industry in America. The population of the present town is approximately 3,400.

TIDES. Those who live near the seashore are quite familiar with the regular rise and fall of the water, which we call the tides. They are caused by the attraction of the moon and sun. The rise is called the *flood,* and the fall is known as the *ebb.*

As the earth rotates, centrifugal force would tend to make objects on the surface fly off like mud on a rapidly rotating wheel, but gravity pulling them toward the center holds them on. As the moon revolves about the earth, its attraction tends par-



THE MOON'S EFFECT UPON TIDES
High tides occur nearest to and farthest from the moon, low tides at points between.

tially to counteract that of gravity on the side of the earth nearest it. The ocean waters on this side can yield to this attraction and bulge out there, making high tide.

As the earth rotates, this high tide tends to remain directly under the moon, thus producing a tidal wave which moves around the earth. If the moon remained stationary, this high tide would seem to move about the earth in twenty-four hours. Since the moon also moves in the same direction, it requires twenty-four hours and fifty-two minutes for the moon to pass the same meridian again. As a matter of fact, the tide lags behind the moon, the amount of the lagging varying at different places. The difference in time between the passage of the moon and high tide is called the *establishment of the port.*

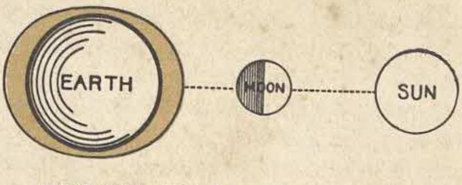
The moon's attraction for the waters on the opposite side of the earth is even less than on the solid earth between, so that the net effect is to produce high tides there also. The waters which produced these high tides came from the regions between the two, where, as a result, there are low tides. Since there are two high and two low tides on the earth at one time, the rotation of the planet will bring high tide to each part of the ocean at intervals of twelve hours, twenty-six minutes, and low tide six hours and thirteen minutes after each high tide.

Since the sun is many times as massive as the moon, the force of attraction between the sun and the earth is about 176 times that between the moon and the earth, even though the distance to the sun is about 93,000,000 miles and the distance to the moon is only about 240,000 miles. But the *tide-raising* force of the sun or moon is the *difference* between its force of attraction at the surface of the earth (on the water) and at the center of the earth (on the earth itself). Since the 4,000-mile distance between the center and the surface of the earth is a smaller fraction of the sun's distance than it is of the moon's distance, the tide-raising force of the sun turns out to be a little less than half that of the moon.

At certain times, the sun and moon are so situated that they pull in the same direction; as a result, the solar and lunar high tides are combined into unusually high tides, called the *spring* tides. At other times, the sun and moon pull at right angles to each other, partially counteracting the attractions of each and producing lower high tides, known as *neap* tides.

Tidal action in mid-ocean is scarcely noticeable, but in bays and inlets, vigorous tides several feet high often rush in, forming what is known as a *bore.* Those of the Bay of Fundy are often more than fifty feet high. Similar conditions are found in the Seine, the Elbe, the Amazon, and in several Chinese rivers. Another tidal phenomenon is found in *tidal races,* strong currents which occur when adjacent bodies of water connected by a narrow inlet have tides of different heights. Such a current is found at Hell Gate, New York City.

Tides are extremely important to navigation, for in many places vessels can enter and leave only during high tide. Tides also serve to carry away waste and sewage that accumulate along the shore. A few attempts have been made to harness the force of the tides as a source of power.



THE BIWEEKLY SPRING TIDES
At new and full moon, the sun and moon combine power, causing the month's highest tides.

E=mc²
EINSTEIN

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